Reimbursement Strategies for Nursing Home Care:

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Developmental Cost Studies

Volume I
Final Report

Howard Birnbaum
Christine Bishop
Gail Jensen
A. James Lee
Douglas Wilson

June 1979

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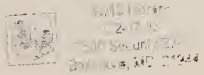

This report is made pursuant to Contract No. 600-77-0068 between the Health Care Financing Administration, HEW, and Abt Associates Inc. The amount charged to HCFA for the work resulting in this report (inclusive of the amounts charged for any prior reports submitted under this contract) is $216,077. The names of the persons employed or retained by the contractor with managerial or professional responsibility for such work or for the content of the report are: Howard Birnbaum, Christine Bishop, Gail Jensen, A. James Lee, and Douglas B. Wilson.

The project officer for this contract was Dr. Thomas Kickham, Office of Demonstration and Evaluation, Office of Research, Demonstration, and Statistics.

The views and opinions expressed in this report are the contractor's and no endorsement by the Health Care Financing Administration or Department of Health, Education, and Welfare is intended or inferred.

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Acknowledgments

This study reports the results of a series of cost analyses on the determinants of operating costs of nursing homes and develops a prototype reimbursement system. The research was sponsored by the Health Care Financing Administration, Department of Health, Education, and Welfare, under Contract No. 600-77-0068. However, the contents of this report do not necessarily reflect the views or policy of DHEW or the Health Care Financing Administration.

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Howard Birnbaum, Ph.D.
Project Director

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Preface

This study was truly a collaborative effort. Each of the investigators participated in continually reviewing the work of all the project members. Nonetheless, the chapters and technical papers of this report do reflect attributable authorship. The credit is:

Chapter 1 - Review of the Study: Howard Birnbaum

Chapter 2 - The Nursing Home Sector, Structure and Operations: Christine Bishop and Howard Birnbaum, with assistance from Patricia Reagan.

Chapter 3 - The Determinants of Nursing Home Operating Costs: Howard Birnbaum, Christine Bishop, Gail Jensen, and A. James Lee

Chapter 4 - A Summary of the Multi-equation Model of Nursing Home Behavior: A. James Lee, Howard Birnbaum, Christine Bishop, and Gail Jensen

Chapter 5 - An Examination of the Reimbursement of Nursing Homes: Douglas Wilson and Howard Birnbaum

Chapter 6 - The Process of Operating a Prototype Nursing Home: Howard Birnbaum, Christine Bishop, Gail Jensen, A. James Lee, and Douglas Wilson

Technical Paper 1 - The Nursing Home as a Firm: Objectives and Constraints: Christine Bishop, Patricia Reagan, and Howard Birnbaum

Technical Paper 2 - Reimbursement Systems in Operation: Christine Bishop

Technical Paper 3 - Methodological and Econometric Approach to Cost Analyses: Gail Jensen, Howard Birnbaum, Christine Bishop, and A. James Lee, with assistance from Christopher Zook

Technical Paper 4 - An Analysis of Nursing Home Costs Based on a National Sample: Gail Jensen and Howard Birnbaum

Technical Paper 5 - Nursing Home Costs in New York: A. James Lee and Howard Birnbaum

Technical Paper 5-A - The New York State Nursing Home Reimbursement System: Michael Sumner

Technical Paper 6 - Nursing Home Costs in Massachusetts: Christine Bishop

Technical Paper 7 - Nursing Home Costs in Indiana: Gail Jensen

Technical Paper 8 - A Multi-equation Model of Nursing Home Behavior: A. James Lee, Howard Birnbaum, Christine Bishop, and Gail Jensen

CHAPTER 1

REVIEW OF THE STUDY*

1.0 Context of the Study

The nursing home industry has been subject to continual public and governmental concern over the past ten years, since the Medicaid and Medicare programs began to pay directly for nursing home care. The problems include rising expenditures, long waiting lists, inappropriate placements and type of care, scandal, and more.[1] The solutions proposed usually involve increasing government regulation and altered reimbursement practices. There have been many iterations of a cycle in which a perceived problem gives rise to changes in reimbursement practices, regulations, or the way regulations are implemented and enforced, and these changes in turn call forth an industry response. The industry is now highly regulated, but not necessarily in a coherent or effective fashion.

A number of specific issues have been identified by regulators, rate setters, and/or the public as problems in need of government action:

- The quality of care provided is often of a low level; moreover, the type of care provided to particular patients is often inappropriate to patient condition.
- Medicaid patients wait at home or in hospitals for nursing homes to accept them.
- Costs per unit of care continue to rise rapidly.
- Medicaid total budgets are rising beyond the ability of state governments to pay for nursing home services leading to a desire to cut back reimbursement rates, eligibility, and utilization.
- Instances of actual fraud may be rare, but are a source of indignation to both the government and the public.

In light of these problems, public policy goals with regard to nursing home reimbursement focus on cost containment, access for public patients, furnishing appropriate levels of quality of care, equity to providers

---

*by Howard Birnbaum

[1] See, for example, the Moreland Commission (1976) and the U.S. Senate Subcommittee on Long Term Care (1975).

and public patients, as well as ease of administrative implementation. It is natural that governmental policies towards improving the performance of the nursing home industry focus on reimbursement policy. After all, government reimbursement practices are partly responsible for the current situation. Where in 1967 national nursing home expenditures were around $1.7 billion, by 1977 they totaled around $11 billion (see Table 2-1).

New directions are being sought for government reimbursement for nursing home care. Nevertheless, in a complex and interdependent world, it should not be expected that a single policy lever, reimbursement practices, will resolve all the problems confronting the nursing home industry. Yet, improved reimbursement practices may move the industry in the direction of public policy goals.

The product of this study is a series of suggestions for designing a prototype reimbursement system which will respond to public policy goals for the nursing home industry. To this end, empirical analyses were conducted to gather evidence about the determinants of nursing home operating costs and how nursing homes react to governmental regulation. In brief, the focus of this exploratory study was to determine which variables influence nursing home cost behavior and how a reimbursement method should take these variables into account in determining a reimbursement rate. These empirical analyses were supplemented with a review of the reimbursement systems currently being used or recently proposed by the state Medicaid programs. It is possible that the recommendations of this study for an improved reimbursement system will be implemented on an experimental basis in a small number of states.

1.1 Review of Empirical Findings

The major analytic component of the study involved multivariate cost analyses on the determinants of average per diem nursing home operating costs. Issues of capital cost and profit allowances were outside the scope of work.

Four sets of data were used: 1) a national sample of nursing homes, and data from homes in the states of 2) New York, 3) Massachusetts, and 4) Indiana. Among the relevant findings that emerge from the national and state cost analyses are: (1) regression analysis can successfully explain average per diem operating cost variation; (2) better data on

patient mix and quality of care in nursing homes are needed; (3) variables explaining average per diem nursing home operating costs behave in line with theoretical expectations; and (4) the determinants of average per diem operating cost vary across different states.

1.1.1 Results of Cost Modeling

The statistical results of the cost modeling were very robust. While there were clear differences in the determinants of per diem operating costs across the states and the nation, many of the results did generalize across the data bases. The differences which did appear, for the most part, could be attributed to variations in the regulatory environment in the different states. Some of the more relevant specific results are summarized below.

Regulation. Regulatory intervention affects the structure of nursing home costs. Nursing homes in states with life safety codes, minimum staff requirements, and occupancy penalties also had higher per diem operating costs than homes without such requirements. The nature of the reimbursement system also affected costs. Nursing homes in states with prospective reimbursement systems had higher costs than homes under flat rate or retrospective systems. This result must be interpreted cautiously. It may be that higher costs are associated with prospective reimbursement to cover the greater risks that facility operators must take, for under such systems where the rate is set in advance it is the operator who is at risk for unforseen events. Other explanations are also possible. Another possibility is that those states with excessively high costs adopted a prospective system in an effort to contain costs. Alternatively, the rates set by states under prospective reimbursement could have been higher than in other states. In brief, the empirical association of prospective reimbursement with higher costs may be due to do confounding by unmeasured variables.

Scale Effects. Although some returns to scale were found for the lower ranges of facility size (i.e., less than 40 beds), in general, scale (or size) of facility had little impact on per diem operating costs. Per diem operating costs also appear to be invariant with respect to occupancy.

Output Descriptors. Case mix measures (in particular, measures of dependence in activities of daily living and diagnoses of patients) had some

slight impact on costs. However, this lack of strong association with costs was confounded by data problems, particularly the absence of adequate measures of quality. Moreover, the national data were based on a sample of patients and led to an errors-in-variables problem with a resultant bias towards zero in the estimated coefficients. The New York analyses, where patient and quality data were more complete, found a stronger association between costs and patient debility. In any event the absence of adequate quality measures in long term care is notorious and hinders both analysis and policy making.

Services. Services provided (such as intravenous feeding, enema, occupational therapy, etc.) did affect per diem operating costs. It should be remembered that more services do not necessarily yield more quality.

Case Flow. Greater patient turnover was associated with higher per diem operating costs.

Facility Characteristics. For-profit facilities had lower per diem operating costs than non-profit homes. While quality measures were not available in most of the analyses, a measure of quality was available for the New York data; there, for-profit facilities still had lower costs than non-profit facilities, after controlling for available measures of quality.

Prices. Providers located in market areas with higher input prices and who pay a higher price for their inputs have higher per diem operating costs.

1.1.2 Results of the Multi-equation Model

A second analytic component of the study involved a multi-equation simultaneous model of the nursing home industry. The results of the multi-equation model underlined the importance of simultaneity issues in analyzing nursing home behavior. While reimbursement practices do affect the costs of nursing homes, facility operators respond to these reimbursement practices, such that reimbursement has a range of often unanticipated effects on variables other than cost. In particular, reimbursement also affects nursing and service intensity, the rates charged to private patients, the degree of access for public patients, as well as average per diem operating costs. For example, prospective reimbursement systems were associated with an increase in per diem operating costs as well as an increase in the number of nursing hours provided per patient day, services provided to patients, and increased access for public patients. It appeared that retrospective reimbursement

systems which were associated with lower costs also were associated with a reduction in service intensity and access to public patients. As mentioned previously, there are a range of reasons why prospective reimbursement may be associated with higher costs. In any event a conservative statement is that neither a prospective nor retrospective system is inherently superior with regard to cost containment and that the choice between the two should be based on other criteria. In brief, prospective reimbursement appears to be a desirable reimbursement system for reasons of improved quality of care and access for public patients. Furthermore, prospective reimbursement allows better planning on the part of nursing home operators, for they know the constraints under which they will have to operate; in essence prospective reimbursement creates an environment where rational management decision making can take place.

Other results of the multi-equation model also are of note. For example, several of the regulatory variables did not have their desired effect on provider behavior; for example, occupancy penalties had no significant effect on occupancy levels, nor did nursing staff requirements lead to increased hours of nursing. In brief the nursing home sector is a dynamic environment. Major tradeoffs exist; nursing home behavior is a function of operator responses to regulation and reimbursement, patient characteristics, inputs, and other factors in the nursing home environment.

1.2 The Behavioral Environment

In addition to considering the empirical results of the study, the design of a prototype reimbursement system must be embedded in the behavioral context of the nursing home industry and bureaucratic behavior. In this context, the nursing home industry can be characterized by "sticky" prices and imperfect markets, as well as heterogeneous production methods and output. While the prices are administered by rate setting agencies, the general principle of cost-relatedness underlying nursing home reimbursement policy serves to partly remove market constraints on operator pricing decisions. Nursing home operators in this environment can be characterized

as having a large degree of control over the rates that public agencies pay for care to public patients. The rate setting agency may feel that it is setting the rate. But it should be recognized that when the rate is set on a cost-related basis, the nursing home operator has considerable control over the rate to the extent that he determines his cost and to the extent that his cost affects his rate.

The cost containing aspects of any nursing home reimbursement system--under a cost-based system of setting reimbursement rates where there is excess demand and where patients incur no out-of-pocket expenses--is the level and manner in which ceiling for the rate is set. Thus, the key to designing an improved reimbursement system is to derive of a mechanism for setting ceilings at a level sufficient to meet quality and access goals, and in a manner which identifies inefficient "outlier" facilities whose costs exceed a ceiling set in accordance with a reasonable level of efficiency. That is, one characteristic of a desirable reimbursement system is to make costs more directly a function of the reimbursement level, and to reduce the dependency of reimbursement levels upon individual home costs.

1.3 The Prototype Reimbursement System

The study concludes that a reimbursement system for nursing home operating costs should be a formula-type system with the following characteristics:

- it should be prospective in nature;
- it should screen individual facility costs to identify "outlier" homes;
- it should make use of good data; and
- it should be administratively easy to operate.

The prototype formula system is designed to achieve a realistic, limited set of objectives. No reimbursement system can be perfect and achieve an optimal result. Rather than design an "ideal," unrealistic system, the proposed reimbursement system concentrates on the extreme situations. It assumes that the majority of homes are operating at reasonable levels of efficiency and quality and that the rate agency should concentrate on "outliers." In this way, the rate agency can use its limited resources to maximize its leverage in moving towards the achievement of public policy

goals such as access for public patients, quality of care, equity of treatment, and cost containment. Once the most serious problems have been resolved in the initial years of operating the prototype reimbursement system, the rate agency then can proceed with a more widespread review of the remainder of the homes. Major efforts will be required to upgrade existing data bases.

In implementing the prototype reimbursement system developed in this report, a rate setting agency would follow nine steps. It would:

- set policy guidelines;
- develop screens to evaluate the reasonableness of nursing home costs;
- set preliminary rates;
- internally review the preliminary rates;
- inform nursing homes of preliminary rates;
- have nursing homes prepare budgets;
- review the budgets to set the final rate;
- consider retrospective adjustments; and
- audit providers.

The essence of the prototype system is the use of screens to identify nursing home "outliers." The screening procedures use cost function analysis to initially evaluate the reasonableness of the costs of any particular home. The screens work to establish a corridor around the range of acceptable costs. Homes with costs which lie outside the corridor--either too high or too low--fail the first screen and are investigated in more detail as to why their costs are too high or too low. Preliminary rates then are set, after considering supplemental data on the home as well as the policy guidelines. Thus, rather than use the cost analysis results to derive formula rates, the rate-setting agency should modify the cost analysis results to provide active incentives and disincentives for providers to alter various characteristics of their facility so as to move in the direction of achieving public policy goals. Again, the system assumes that the majority of homes are operating at a reasonable level of efficiency. Most homes can expect that their previous costs--subject to some incremental alterations and allowance for extraordinary circumstances--plus an inflation factor will be approved as the preliminary rate for the next year. However, the procedure does identify a small set of outlier homes for detailed investigation.

Once the home is informed of its preliminary rate as well as the policy guidelines, it must prepare and file a budget request with the rate agency. If the home finds that its proposed budget is in line with the preliminary rate, then it need file only the budget request; in essence, the preliminary rate becomes the prospective rate. If the facility finds that it cannot operate within the preliminary rate, then it may file a request for an exception along with its budget request. The exception request is resolved in a budget review.

Retrospective adjustments are to be minimized. This will force facility operators to conduct their planning activities in advance and take the planning, prospective budget preparation, and rate determination process seriously. Hence, incentives for proper management control are maintained. Retrospective adjustments would be allowed only for changes in the regulatory and reimbursement rules and for well defined exceptional circumstances (e.g., severe flu epidemics) which lead to cost changes from unavoidable circumstances beyond the operator's control. Such severe limitations on retrospective adjustments may not be politically possible. The point is that the nursing home operator should be at risk as much as possible.

1.4 Components of the Study

The report reaches its conclusions about a prototype reimbursement system in a series of steps, presented in Chapters 2 through 6 and supporting Technical Papers #1 through #7, contained in Volume II.

Chapter 2 introduces the problems confronting the study with a brief description of the nursing home and regulatory environment.

Chapter 3 presents the empirical results of this study with regard to the determinants of nursing home operating costs. The chapter presents an integrated discussion of four sets of analyses. The multivariate cost analyses are based on survey data from (1) a national sample of nursing homes, as well as data from the actual cost reports submitted by nursing homes to the Medicaid rate setting authority in the states of (2) New York, (3) Massachusetts, and (4) Indiana. Three years of data were analyzed for each state.

Unlike the static analyses in Chapter 3, Chapter 4 takes a somewhat different approach in that it presents the results from a multi-equation simultaneous model of the nursing home sector. It is based on the idea that

nursing home operators alter their behavior in response to reimbursement and regulatory practices. The multi-equation analyses treat some of the variables that were considered exogenous (pre-determined) in the static cost analyses as endogenous characteristics of nursing home facility behavior which respond to policy directives. Thus, the multi-equation model explores the impact of reimbursement and regulation on occupancy rates, public private patient mix, the level of services, and the private rate--variables under the control of nursing home operators which can be affected by reimbursement policy. By its very nature, a discussion of the derivation of simultaneous equation results is technically complex. Chapter 4 summarizes the approach and a complete discussion of the empirical results is in Technical Paper #8. The basic conclusion of this chapter is that the nursing home environment is dynamic, such that pushing one button may lead to unexpected results.

Chapter 5 is a conceptual examination of nursing home reimbursement policies. It considers a number of problems inherent to the existing reimbursement systems and discusses a number of alternative reimbursement systems which are designed to meet existing problems in the nursing home industry. Briefly, existing Medicaid lgislation requires that patients incur no out-of-pocket costs, that there be freedom of choice for patients, and that nursing homes be reimbursed on a cost-related basis. These structural parameters severely curtail the options open to a state reimbursement authority. In this context, Chapter 6 concludes this report and discusses a prototype formula-based screen prospective reimbursement system that, within the context of current legislation, appears to come closest to achieving policy goals of cost containment, access for public patients, furnishing appropriate levels of quality of care, equity to providers and public patients, and ease of administrative implementation.

The Technical Papers present the supporting analyses. A theoretical review of the relevant literature is contained in Technical Paper #1. Technical Paper #2 reviews existing and proposed reimbursement plans in use in states across the nation. Technical Paper #3 reviews the methodology used in these cost analyses in the context of outlining a suitable methodology for states interested in implementing multivariate cost analyses on data from their own nursing homes. Technical Papers #4, #5, #6, and #7 contain detailed discussions of each of the separate analyses and data, for the national, New York, Massachusetts, and Indiana data, respectively. Technical Paper #8 discusses the multi-equation model of nursing home behavior.

CHAPTER 2*

THE NURSING HOME SECTOR: STRUCTURE AND OPERATIONS

The structure and operations of the nursing home sector today is the result of many years of changing supply and demand conditions and governmental actions. An understanding of the current nursing home environment is a precursor to designing public reimbursement policies to impact on the nursing home sector in a manner consistent with public policy goals.

2.1 Overview of the Nursing Home Sector

Nursing homes represent a middle ground in the continuum of available types of residential long-term care. Chronic hospitals provide more intensive services while rest homes provide less intensive services. Additional settings for long-term care for chronic conditions include rest homes, outpatient services, day programs, and at home through home health services or from family members. In contrast to the less intense forms of long-term care, the cost of nursing home care is, under certain conditions, covered by Medicaid and, to a far lesser degree, by Medicare.[1] This unequal fiscal treatment of alternative forms of care means that it may be less expensive to the patient or his family to receive the more costly and, perhaps excessively intense nursing home care than a less costly and perhaps more appropriate type of less intense care. This unequal fiscal assistance distorts the relative demands of patients for different types of long term care.

2.1.1 Demand Factors

The nursing home sector emerged as an important provider of long-term care in response to increased patient demand for such care, funded by governmental programs providing the elderly with an ability to pay for such care (see Table 2-1). The Social Security Act, passed in 1935, was the initial governmental income support program for the elderly; some state public assistance programs followed. However, it was not until after the 1960 Kerr-Mills Bill established Medical Assistance to the Aged that state and federal progams began paying substantial amounts for health care services to the elderly. Until 1960, private sources accounted for upwards of

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*by Christine Bishop and Howard Birnbaum

[1]Some limited federal and state financial aid to these other long term care options is available, but at a level far below what is available for nursing home care.

Table 2-1

NATIONAL HEALTH EXPENDITURES ON NURSING HOME CARE BY SOURCE OF FUNDS

(In $ Millions)

Fiscal Year	Total	Private	Public			
			Total	Medicare	Public Assistance Medicaid	VA
1940	$ 28	$ 28	$ 0	--	--	--
1950	178	167	11	--	--	--
1955	291	244	47	--	--	--
1960	480	353	127	--	127	--
1965	1,271	822	449	--	448	1
1966	1,407	804	602	--	588	14
1967	1,692	785	907	97	784	26
1968	2,070	604	1,466	344	1,089	33
1969	2,465	762	1,703	367	1,295	41
1970	2,875	1,208	1,667	292	1,327	48
1971	3,365	1,338	2,027	247	1,709	71
1974	7,450	3,649	3,801	214	3,462	125
1975	9,100	4,086	5,014	273	4,579	162
1976	10,600	4,744	5,856	302	5,365	189

SOURCE: 1940-1971: Cooper, Barbara S., Nancy L. Worthington, and Mary F. McGee, Compendium of National Health Expenditures Data, USDHEW/SSA/ORS Publication No. (SSA) 73-11903, 1973.

1974-1976: Gibson, Robert M. and Marjorie Smith Mueller, "National Health Expenditures, Fiscal Year 1976", Social Security Bulletin, April, 1977, Vol. 40, No. 4.

80 percent of national health expenditure on nursing home care. By 1965 private sources accounted for less than 65 percent.

In 1965, the Social Security Act was amended to support medical care for people over 65 (Medicare, Title XVIII) and for people receiving income support under other assistance programs and the medically indigent (Medicaid, Title XIX). These programs, which began to pay benefits in 1967, sharply increased the governmental share of nursing home spending. As an entitlement program for the poor, the Medicaid program is, by far, the chief governmental purchaser of nursing home care[1] and accounts for over 90 percent of the public funds for nursing home care. The rapid growth of governmental expenditures on nursing homes--from $127 million in 1960, to $602 million in 1966, to $5.8 billion in 1976--has generated efforts to contain costs including curtailments in eligibility and service coverage. Equally significant is the rise in per capita expenditures; in terms of 1960 medical care dollars, national per capita nursing home expenditures rose from $3.62 in 1960 to $9.19 in 1967 to $30.35 in 1973 (U.S. Census, 1975). Efforts at devising new reimbursement systems are part of this general concern, although other concerns over quality, access, and administrative effort also are involved.

Paralleling these governmental fiscal trends and also contributing to increased demand for nursing home care is the increasing participation of women in the labor force, which rose from 27 percent in 1940 to almost 50 percent in 1977 (U.S. Census, 1975); this trend meant that fewer women were at home to care for their elderly. A similar trend, and one that also is expected to continue in the future, is the absolute and relative growth of the elderly population who are potential recipients of nursing home care. These trends suggest that the public policy focus on nursing home expenditures

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[1] The Medicaid program provides matching funds to states which agree to pay for health services of many types, including unlimited nursing home care, to many categories of low income persons. In contrast to the relative munificence of Medicaid, Medicare is far more restrictive. Medicare provides payment for up to 100 days of post-hospital care for elderly patients who require specially certified, intense care in skilled nursing facilities. Nursing home stays under Medicare provide only a substitute for long hospital stays and intensive post-hospital care and rehabilitation.

is likely to continue. In contrast, private health insurance has not played a major role; in 1974, less than 16 percent of the over-65 population held private insurance for nursing home care (Mueller and Piro, 1976).[1]

2.1.2 Supply Response

The result of these demand trends has been a steady increase in the number of nursing home beds. While historical nursing home inventories and definitions have been inconsistent, by 1940 there were around 1,200 homes providing 25,000 beds (Block, 1942, cited in Moraney and Kurtz, 1975). By 1954, there were 7,000 nursing homes with 180,000 beds (Solen and Barey, 1954, cited in Eagle, 1968). Steady growth continued in the post-war era, with the number of beds increasing from 500,000 in 1963 to 1,176,000 in 1973 (see Table 2-2). This increase was accomplished by a change in facility bed size rather than an increased number of firms. Apparently, many small facilities, built originally as private residences, dropped out of the market, while larger facilities built specifically as nursing homes entered it.

There is a wide diversity of ownership. From the start, a substantial portion of the industry was owned and operated on a for-profit basis. Non-profit homes include those run by state and local governments as well as those run by charitable and religious organizations. For-profit facilities--70 percent of the industry--run the gamut from small family businesses run by owner-operators often in converted residences, to those operated by real estate trusts and interstate chains. The nursing home chain--a development of the last ten years--has accelerated the movement of the industry away from dominance by "mom and pop" operations.

2.2 The Nursing Home Industry Today

A recent estimate indicates that there are around 16,000 facilities--three times the number of hospitals--providing nursing care and personal care with nursing in the United States to 1,074,000 residents (USDHEW, NCHS, 1975) with an average size of 74 beds. In addition to variations in ownership,

[1]The growth of hospital health insurance in the post-1950 period may have indirectly impacted on nursing homes; by increasing the demand for hospital care, this care may have been redistributed away from elderly patients who then were pushed towards the alternative of nursing homes.

Table 2-2

NURSING HOMES 1963-1973

	Number of Facilities	Number of Beds	Average Size	Number of Residents	Utilization Rate (Percent)	Percent For Profit
1963	13,086	507,530	39			81.8
1967	14,489	765,148	52			77.9
1969	14,998	879,091	59	793,074	90.2	76.7
1971	16,849	1,141,652	68	1,024,254	89.7	74.8
1973	15,737	1,175,865	74	1,074,480	91.4	70.0

Source: HEW, National Center for Health Statistics, Vital and Health Statistics Series 12, as compiled in American Health Care Association (n.d.), and Eagle (1968).

they differ in the type of care provided, the cost of care, their geographic dispersion, and their sources of financing. In brief, the problems of the industry can be characterized in terms of high and rising costs, inappropriate quality, and inadequate access.

2.2.1 Type of Care Provided

Within the broad rubric of "nursing home," several categories of facilities can be distinguished. As of 1973 nursing homes provided two types of care, nursing care and personal care with nursing[1] which are roughly equivalent to two certification categories, Skilled Nursing Facilities (SNF) and Intermediate Care Facilities (ICF); SNF homes are to provide more intensive care to "sicker" patients than are ICF homes. A facility becomes an SNF or ICF by seeking state certification for and meeting the standards necessary to serve patients under Medicare and Medicaid; thus, uncertified facilities may be homes that choose not to participate in public programs, or homes that would like to participate but cannot meet the certification standards. Increasing numbers of facilities include both types of certified beds; this allows transfer within the facility if patient need changes. Table 2-3 shows results from the 1973-74 National Survey of Nursing Homes by certification. There were 4,938 Skilled Nursing Facilities certified by either Medicare or Medicaid or both, representing 31.3 percent of the total homes. They maintained 411,937 residents, 38.4 percent of the total nursing home population. The SNFs offered 441,902 beds, or 37.6 percent of the total number of available nursing home beds. Homes which were exclusively ICFs totaled 4,425 facilities, representing 28.1 percent of all nursing homes. There were 3,613 non-certified homes, 23 percent of the total. They maintained 139,355 residents, 13 percent of the total, and provided 160,167 beds, 13.6 percent of the total nursing home residents.

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[1] According to the National Center for Health Statistics (1975), a nursing care home is an institution in which fifty percent or more of the residents received nursing care during the week prior to the survey and where at least one full-time registered nurse (RN) or licensed practical nurse (LPN) was employed. A personal care home with nursing is an institution in which some, but less than 50 percent of the residents received nursing care during the week prior to the survey and where at least one full-time RN or LPN was employed; or an institution in which some of the residents received nursing care during the week prior to the survey, no full-time RN or LPN was employed, and the institution either provided administration of medicines or supervision over self-administered medicines, or provided assistance with three or more activities for daily living.

Table 2-3

NUMBER AND PERCENT OF NURSING HOMES, RESIDENTS, AND BEDS BY CERTIFICATION STATUS OF HOME: U.S., 1973-74

	Homes[1]		Residents		Beds[2]	
Total	15,737	100.0	1,074,480	100.0	1,175,865	100.0
Not Certified	3,613	23.0	139,335	13.0	160,167	13.6
Medicare Only	338	02.2	23,459	02.2	29,194	02.5
SNF Only[3]	2,273	14.4	162 793	15.2	173,431	14.8
ICF Only[4]	4,425	28.1	236,421	22.0	253,105	21.5
Medicare and SNF	2,665	16.9	249,144	23.2	268,471	22.8
Medicare and ICF	- N/A -		3,617	00.3	3,797	00.3
SNF and ICF	1,250	7.9	129,579	12.1	147,339	12.5
Medicare, SNF and ICF	1,127	7.2	130,128	12.1	140,356	11.9

[1]Includes only those nursing homes providing some level of nursing care.

[2]Includes all beds in the nursing home, whether the beds are certified or not.

[3]Homes certified as skilled nursing homes under Medicaid.

[4]Homes certified as intermediate care facilities under Medicaid.

Source: USDHEW, National Center for Health Statistics, 1975.
These estimates are based on a national sample survey of 2,100 nursing homes providing some level of nursing care.

While there are distinctions between SNF and ICF homes and patients, it is important to recognize the limitations of this dichotomy, for patient misclassification is rampant. In 1971 a Government Accounting Office report found that between 40-80 percent of patients in SNF homes across the nation did not require SNF-level care. A recent report by Community Research Applications (1976) investigated this phenomenon and concluded that care to patients in SNF and ICF homes across the nation varied widely. State differences in regulations, facility specifications, assignment, and reimbursement rates all were contributing causes. Many states have a very high population of very debilitated patients in ICF homes, while other states have a very low proportion of debilitated patients in ICF homes. The range of public patients across different states receiving ICF as opposed to SNF care varied from 10.7 to 98.2 percent (CRA, 1976, p. I-6). In brief, states differ widely in the standards of care they provide for different patients; the term "SNF patient" has a very heterogeneous meaning.

Not only is the type of care provided to nursing home patients often inappropriate to the patient's condition, but it is often of poor quality. While precise information on quality in terms of patient outcome is not widely available, a large number of studies and reports have documented the low quality of care in terms of inputs and process of care. These studies, including the Moss Committee Report (U.S. Congress, 1974), and the Moreland Commission (New York State, 1976), as well as numerous reports by state governments and the judgments and testimony of experts leave little doubt of the pervasiveness of inadequate quality of care (as well as profiteering, fraud, and abuse).

2.2.2 Access to Care

There is wide variation in the percent of the elderly population in nursing homes. At the low end, 1.7 percent of the over-65 population in Mississippi was in nursing homes in 1972-73, while at the other extreme, 8.1 percent of the elderly population in Iowa was institutionalized (Community Research, p. I-17). A similar unequal distribution of nursing home beds exist. While the national average in 1974-75 was 51.9 beds per thousand population over-65, the range was from 116.8 in Minnesota to 15.9 in West Virginia (American Health Care Association, n.d.)

Compounding the problem of unequal geographic distribution is the problem of excess demand. The average occupancy rate in 1974 was 91.4 percent (USDHEW, NCHS, 1975). After allowing for empty beds due to patient turnover and new construction, it appears that, at an aggregate level, the nursing home industry is operating at close to capacity. Data from the 1972-73 NCHS survey (July, 1977) indicates that 72 percent of all homes maintained lists containing the names of 152,300 persons; these persons would have utilized over 13 percent of the available beds. While this number includes double-counting of patients on multiple lists, in a majority of homes the demand for beds exceeded the available supply.

2.2.3 Costs of Care

In 1972, the average cost of nursing home care was $16.44 per patient day. Table 2-4 reveals that nursing staff costs were about one third of this expense, and total labor costs were close to 60 percent of the total cost. It appears that there are systematic variations in cost by region, with the Northwest exhibiting the highest per diem costs (Table 2-5). Larger facilities in 1972 were more costly per patient day than small facilities (Table 2-5), but it should be remembered that larger facilities are probably newer and more expensive as well, leading to the appearance of diseconomies of scale. In fact, the statistical analyses of Chapter 3 suggest that in terms of operating costs, there are neither economies nor diseconomies of scale.

In 1974, the 2,106,000 persons in nursing homes incurred costs of $8.28 billion. Half of these costs ($4.11 billion) were incurred by the 938,000 persons residing in skilled nursing facilities; a fourth of the costs ($2.19 billion) were incurred by the 604,000 persons residing in combined Skilled Nursing and Intermediate Care Facilities; the rest were incurred by the 334,000 persons in only Intermediate Care Facilities ($1.27 billion) or the 230,000 persons in uncertified homes ($0.71 billion). (Calculated from 1973-74 NCHS Nursing Home Survey)

Evidence on the determinants of the cost of care is confusing. For example, one would expect intuitively that as the amount of per patient care increased, costs too should increase (since additional inputs cost more money). Yet, both Commmunity Research Applications and also Winn, Bennett, and McCaffree (1976) found no statistically significant relationship between

Table 2-4

Average Establishment Cost of Providing Care Per Resident Day and Percent Distribution of Average Cost by Cost Components, U.S., 1972

Cost Component	Average Establishment Cost of Providing Care Per Resident Day[1]	
	Cost in Dollars	Percent Distribution
All Components	$16.44	100.0
Labor Expense	9.84	59.9
Fringe Benefits	.82	5.0
Wages	9.02	54.9
Nursing Staff	5.54	33.7
Other Staff	3.48	21.2
Fixed Expense	2.52	15.3
Operating Expense	3.39	20.6
Food and Drugs	1.61	9.8
All Other	1.77	10.8
Other Expense	.68	4.1

[1] Based on 15,033 homes in business for more than two years and 355,791,544 resident days.

Source: National Center for Health Statistics
These preliminary estimates are based on a national sample survey of 2,100 nursing homes providing some level of nursing care. See the appendix for information on the sampling variability of these estimates.

Table 2-5

PER DIEM COSTS BY REGION AND SIZE
1972

	Per Diem Costs
Total U.S., All Facilities	$16.44
Region	
Northeast	22.02
North Central	15.04
South	14.13
West	15.56
Size	
Less than 50 Beds	13.88
50-99 Beds	15.64
100-199 Beds	16.71
200 Beds or More	20.41

Source: USDHEW, National Center for Health Statistics, 1975, Table C.

the absolute amount of per patient care and the cost of care. In contrast, Winn et al. did find that the relative amount of care provided to a patient of a given condition was related to the cost of care. This and other results suggest that the quality of care delivered to patients of particular conditions must be held constant for an accurate understanding of the determinants of nursing home costs. Yet, such quality data are notoriously absent from virtually every nursing home data base. This problem is discussed in more detail in Chapter 3.

Other evidence is equally mixed. Consider the effect of the size of the nursing home. The Moreland Commission (New York, 1976) found that size was the key determinant of operating cost. In contrast, Ruchlin and Levy (1972) found that size was not statistically significantly related to average operating cost. Skinner and Yett (1970), too, found a disparate set of results. Depending on the definition of size, costs either increased up to some level and then decreased (an inverted U-shaped cost curve), were unrelated to operating costs, or decreased up to some relatively small size and then became unrelated to costs. Both Ruchlin as well as Skinner and Yett found that occupancy rate was negatively related to cost.

Equally mixed results are present with respect to patient need. While one might expect that more debilitated patients require more care and hence cost more, Skinner and Yett found that partially debilitated patients cost more than either independent or totally debilitated patients. However, the Moreland Commission concluded that cost variations had nothing to do with patient need.

These and other studies which investigated the determinants of nursing home costs provide unsatisfactory answers and raise many methodological concerns. A major purpose of this study is to investigate further these questions on the determinants of nursing home costs. Chapter 3 discusses our results.

2.2.4 The Residents

Almost 90 percent of nursing home residents in 1973-74 were 65 years of age or older (USDHEW, NCHS, 1975). Seventy percent were female and women are an increasing proportion of the residents in the older age groups. In terms of impairments, younger residents are more likely to suffer from mental illness, mental retardation, and loss of the use of limbs through

paralysis or amputation; older residents are more subject to senility, arthritis, glaucoma and cataracts, and heart trouble.

Evidence on why residents choose a particular home suggests that the quality of care available plays a negligible role (Baumgarten, Rao, and Ring, 1975). Residents show a conspicuous lack of searching among alternative homes; for 78 percent of the nursing home patients surveyed, no other home was considered. Choice criteria for the remainder included "favorable impression of facilities" (21 percent), advice of others (13 percent), religious affiliation (10 percent), location (7 percent), medical care (3 percent), and cost (2 percent). Thirty-six percent of the patients were not involved in the choice. The fact that a consumer can find only certain combinations of services available in the marketplace makes choice all the more limited. Baumgarten et al. (1972, p. 2) found that "despite the seemingly large number of nursing homes available, . . . the number of their offerings is so segmented that for most families very few homes are suitable."

Econometric studies on the demand for nursing home care are at an aggregate level (Chiswick, 1976) or deal with only the Medicare portion of the market (Feldstein, 1971). Further, Chiswick's study assumes that both public and private patients respond similarly to the price of care, despite Medicare and Medicaid subsidies. The multi-equation model in Chapter 4 considers these issues.

While health care consumers of all types are hindered in their consumption choices by ignorance about complex medical issues, the information problem is especially severe in the context of nursing homes. The usual limitations are increased by physical and psychological disability, with the result that the patient's choice, if there is one, is made by an agent--a family member, social worker, or physician. However, (perhaps because nursing home care is usually a last resort) patients, their families, and even professionals do not appear informed about what constitutes good care or where it can be purchased (c.f., Baumgarten et al.). Since consumers make their choice about which facility to enter at a single point in time and have little or no opportunity to change facilities even if they are dissatisfied, the nursing home administrator has more of an incentive to make his home attractive to shoppers for care, rather than to provide high quality care for actual residents.

Physicians, who play key roles in determining the demand for hospital care, are notable by their absence from the nursing home scene. The conventional wisdom has it that the nursing home patient is not interesting enough or lucrative enough to induce the physician to provide on-going care. It appears that a physician may care for an older person for a good part of his life and then essentially abandon him to the care of the nursing home. This is even more likely in cases where a specialist, who sees his role as dealing with a particular type of illness rather than with the whole patient, cares for the patient during a hospital stay.

In sum, there appear to be few external incentives for providing quality care aside from meeting government regulations. This point is especially relevant since over 60 percent of nursing home residents (who have been in a facility for more than one month) had spent more than a year in the nursing home.[1] Patients who leave a nursing home either go home or die. They rarely transfer to other homes (USDHEW, NCHS, 1977).

Public Versus Private Patients

Facilities vary in their mix of public and private patients, as well as the rates charged to public and private patients. Since people pay throughout their lives to assure that their neighbors are of similar social status, one would expect nursing homes also to specialize in low income Medicaid or higher income private patients. In fact, the distribution of nursing homes in terms of their public-private mix is bimodal. While 60 percent of nursing home patients are publicly funded, over 54 percent of the nursing homes in the nation have 80 percent or more of their patients publicly funded (calculated from NCHS data).

Since private patients are paying for their own care, one could expect them to value and search for homes providing more amenities and services, which in turn imply higher costs and higher rates. In fact, the national average rate charged to private patients in 1972-73 was $16.23 while the rate charged to Medicaid patients was $13.75 (calculated from NCHS data).

2.3 Governmental Regulation of Nursing Homes

Systems of nursing home regulations have arisen in an iterative process as responses to perceived problems. Since the problems differ

[1] Medicare patients, whose length of stay is likely to be shorter than a month, are underrepresented in this tabulation.

depending on the orientation of the observer as well as the environment, it is not surprising that 50 related but different regulatory systems have evolved as a result of the interaction of federal and state governments with the industry itself.

When the success of regulation is measured on a number of goal dimensions, it is clear that there is a tradeoff among these goals. For example, successful per patient day cost containment may result in deterioration of quality as homes attempt to cut service provision and expenses to keep them in line with low reimbursement rates.[1] Incentives for quality care or for increased access for more disabled patients involve paying higher rates to homes for such products, but may increase state budgets for nursing home care.

The following can be identified as widely-accepted goals for nursing home regulation:

- cost containment through control of unit costs and/or through control of total expenditures. A cost containment objective can be interpreted as implying control of government budgets.

- maintenance or improvement of quality of care. This goal may compete with cost containment insofar as higher quality implies increased costs; on the other hand, if facilities are producing nursing home services inefficiently, it may be possible to maintain quality at lower cost through encouraging efficient production.

- access to care for patients, classified by geographic location, treatment needs, and payment mechanism (private, Medicare, or Medicaid); this goal includes access of future as well as current patients, in other words viability of supply. Improved access can mean increased costs with services provided to more individuals; however, adequate access can also mean reduced costs and improved quality, through accurate patient placement (i.e., shortened lengths of stay and placement in lower levels of care if appropriate to patient conditions).

- equity across providers and payors requires that equals be treated equally (horizontal equity) and legitimate differences of situation be appropriately recognized (vertical equity). Equity is sometimes cited as a separate goal although it is preferable to see this as a constraint on any government regulatory system; without equity, regulation can be challenged as capricious and illegal. Equity can be evaluated for facilities and for patients within the universe considered here, the providers and patients participating in the Medicare and Medicaid programs.

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[1] Evidence to this effect is presented in Chapter 4.

- containment of administrative costs. There are clearly trade-offs between costs of administration and more intense regulation directed toward control of cost, quality, and access. In addition, any regulatory system must be administratively and politically feasible. This aspect is a constraint on the regulatory system, while administrative cost containment may be seen as an argument in the policymaker's objective function.[1]

The following paragraphs highlight several particularly relevant aspects of nursing home regulation. A more complete discussion of existing types of reimbursement systems is in Technical Paper #2. The first aspect to note is the trade-offs between the achievement of particular goals, such that some regulations negatively affect the achievement of other goals. The second aspect is the apparent misdirection of some of the existing regulations.

Consider the case of licensure and certification. Under state law in most states, a nursing home must be licensed in order to provide nursing home services to the public. Certification goes beyond licensure, for it is necessary for participation in public payment programs of care and is measured in terms of inputs that are provided. In practice, licensure and certification are often responses to consumer and public complaints and scandal with regard to low quality providers. Thus, licensure laws typically specify minimum nursing hours, fire resistant construction, and minimum per patient floor space. However, input standards do not guarantee quality care, for the inputs can be used with varying degrees of effectiveness. As an alternative, one can envision licensure and certification standards based on the outcome of care provided (e.g. Bicknell and Walsh, 1976; Jones, 1976).[2] Licensure and certification of facilities is directed toward quality assurance. Their strength as a policy tool depends on the level of inputs required under the standards, the vigor of enforcement, and the relationship between inputs and quality. There are tradeoffs between these and the other three tools: standards need be less stringent and enforcement less vigorous as the financial incentive for quality care in the reimbursement mechanism becomes more

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[1] Especially important here is the prevention of fraud and abuse. Some might even argue that public nursing home policy is centered around bureaucratic reactions to nursing home scandals and efforts to eliminate embarrassing future newspaper headlines.

[2] The cost and administrative feasibility of output standards are subject to great controversy and are discussed in Chapter 5.

compelling; high standards and vigorous enforcement may discourage industry expansion (or even encourage contraction of bed availability to below desirable levels); and enforcement of standards for levels of care become meaningless as a quality assurance tool if patient placement is not monitored, since patients may then receive inappropriate care.

The development and enforcement of standards for certification have responded to political forces. The chronology of nursing home regulatory development and enforcement shows regulatory agencies trying to balance the demands of two opposing forces: first, some lawmakers and consumer groups work for higher standards especially in sensitive areas like fire safety, where lost lives due to unenforced regulations make headlines; and second, facilities and payment agencies both wish to hold down costs for care and to maintain existing capacity. Standards have been promulgated and enforced with varying degrees of discretion and sensitivity to what existing facilities could comply with. For example, when Medicare first began to cover nursing home care, many facilities were quickly certified with little regard to their actual condition, since otherwise the bed supply would not have been in place to meet the expected surge of demand; not only would this have led to unsatisfied demand by beneficiaries, but it would have, it was felt, prolonged costly hospitalization of Medicare recipients. It is possible to interpret subsequent tightening of standards as the result of recognition that higher standards would not completely choke off supply. At the state level, the enforcement of the Life Safety Code (promulgated by the National Fire Protection Agency and written into law by the Moss Amendments of 1967) is a similar story: although the design and construction of some facilities make them inherently ineligible for certification under this code, the practice has arisen of granting successive waivers to facilities found to be in violation in order to maintain supply. In the same vein, regulations of staff requirements have apparently been kept low in response to a supposed "shortage" of registered nurses in some states (see U.S. Senate, 1974).

In general, the enforcement of quality regulations leaves much to be desired. In most states, one agency carries out state licensing inspection and certifying inspections for both Medicare and Medicaid (U.S. Senate, 1974, p. 76). Inspections are typically infrequent, often announced in advance, and tend to concentrate on the physical plant rather than on

patient care. Sanctions short of closing the facility are unavailable in most states. This last point implies that deficiencies may be ignored by the operators with impunity, since inspectors recognize that great hardship can be caused by moving elderly patients.

Noll (1976), Ruchlin (1978) and others have argued that the typical result of input-oriented regulation is to intervene in the internal management process in a manner which artificially controls and delays technological innovations. Noll argues that there is little contradictory evidence in the economic literature to the statement that, with the exceptions of natural gas prices, no depressing effect of regulation on price has been found. By setting minimum standards for the lowest common denominator of homes (i.e., the worst quality homes), excessive standards apparently are applied to most of the firms in the industry with resulting cost increases, reductions in efficiency, and the elimination of potential avenues of competition.

While a detailed discussion of nursing home reimbursement policies is contained in Technical Paper #2, some overview comments are appropriate here. In general, direct regulation of price in the nursing home industry is carried out for services purchased by government agencies, specifically under the Medicare and Medicaid programs. Prices charged to private payers are not regulated. Reimbursement for SNF care provided to Medicare beneficiaries is carried out on a retrospective reasonable cost basis paid for by the federal government (see USDHEW, 1976). Under Medicaid, individual states pay for nursing home care for eligible recipients using state and matching federal funds. The individual states set rates of payment for nursing home care, within federal guidelines. Prices are set on a per patient day basis. Some states set flat rates for all facilities in a given class, while others set rates based on costs in individual facilities. In general, rates are set retroactively, and are based on actual costs; other states project costs into the future to set rates prospectively. Legislation passed in 1972 (Public Law 92-603) required all states to develop nursing home rate setting methods based on costs by July 1, 1977.

It should also be noted that rate regulation is typically the domain of a rate setting agency operating separately from other agencies involved in nursing home regulation.

2.4 Conclusion

In brief, this chapter has pointed out the numerous problems that characterize the nursing home industry. Issues of cost containment, quality of care, access, and administrative ease pervade discussions of improving its performance. A key ingredient to improving the nursing home situation is a better understanding of the determinants of their costs. Chapter 3 presents empirical evidence as to the determinants of nursing home operating costs. Because there are conflicts among the goals as well as tradeoffs between the policy tools which may exert leverage over the achievement of these goals, it is important to root a discussion of a more desirable reimbursement mechanism for nursing homes in an understanding of the behavior of nursing home operators. As shown in Chapter 4, nursing home operators clearly respond to the range of existing regulations. For regulation to be effective in the achievement of public goals, it must correctly harness the objectives of the nursing home operators to respond in their own self-interest to achieve public goals.

CHAPTER 3*

THE DETERMINANTS OF NURSING HOME OPERATING COSTS

3.0 Overview

This chapter reviews and synthesizes econometric investigation of the determinants of nursing home operating costs for a national sample of facilities and for facilities in three states: New York, Massachusetts, and Indiana. The national data were for the one year (1972) while the state analyses used data over three years (1973 or 4 to 1975 or 6). The discussion here is carried out independent of concern for how such investigation may be used to set rates: the purpose is to report on the series of cost analyses in a technical sense, i.e., to explain what makes a significant difference to nursing home operating costs.

Section 3.1 contains a general discussion relating the current work to the econometric cost function literature. Section 3.2 contains a more specific discussion of what is expected to affect average operating costs in nursing homes; assumptions and hypotheses are made explicit. Section 3.3 presents empirical specifications which allow hypotheses to be tested using available data, which unfortunately are never as complete as one would like. Section 3.4 reviews findings from the analyses, highlighting the importance of the potential cost determinants. Technical papers T-2 through T-7 present further discussions of the methodology, the detailed results of the national and state analyses, and the data.

In the pages that follow we focus on the cross-sectional average operating cost studies completed for each substudy. In addition to this issue, the Technical Papers consider a variety of measures of case mix and the behavior of changes in costs over time. The interested reader is referred to the Technical Papers for an elaboration of results on each of these topics.

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3.1 Conceptual Approach

This section summarizes our theoretic or conceptual view of nursing home cost behavior. To start at the most basic level, it is a fundamental premise of this project that past operating costs of nursing homes are correlated with or explained by certain cost factors and are the result of a cause and effect process. To fit a cost relationship, it is not necessary to model this process itself. Economists believe this relationship involves choices by providers of production methods, and thus inputs like labor, supplies, and equipment, in a way that maximizes an objective function subject to constraints including input prices and demand. If these input factors can be translated into measurable dimensions of output, their impact on past costs can be estimated quantitatively. If the process which determined costs in the past can be expected to operate in the future, then the cost relationship will also hold, and future costs can be predicted given future values for the cost factors.

The variables examined here as potential determinants of cost are chosen for three overlapping reasons:

1. Economic theory predicts that certain factors will affect costs, e.g. input prices, scale of production activity, and product characteristics.

2. Certain factors are believed by rate setting policymakers to affect costs, as indicated by their treatment under rate policy, e.g. facility size, location, and ownership.

3. Other studies (e.g., Ruchlin and Levy, 1972; Skinner and Yett, 1973) of nursing home costs have emphasized certain variables, for example patient mix.

The cost function of economic theory is a schedule relating the minimum costs of production to the output produced (Wallis, 1974). As output and input prices increase, so will costs. In addition, economies of scale and utilization are possible, such that there may be decreasing average costs as the output measure and the occupancy rate

increase. Thus, the model should allow for the possibility of scale effects.

While ascertaining the existence of such effects is now a standard interest to cost function analyses, certain special attributes of the nursing home industry indicate a variety of additional concerns. First, the "output" or "product" of nursing homes cannot be meaningfully measured as a single quantity. Whereas patient-days of care is a useful indicator of the output level, it is only one of several output dimensions. In particular, the number of patient days per se reflects neither variation in the "quality" of care nor in the "needs" of patients receiving care--e.g. it may be more expensive, ceteris paribus, to care for a non-ambulatory patient than for an ambulatory patient. Thus, the level of output in the nursing home cost function is more correctly a vector of home characteristics, including the number of patient-days but also including patient, service, and quality characteristics.

Second, the nursing home industry is regulated. In an unregulated industry, facility type would not be an explanatory variable since relevant output differences would be reflected in the patient and service characteristics. However, as a consequence of grouping by facility type in rate setting, historical cost differences may be maintained over time, independent of patient quality of care, and so forth. Furthermore, regulations may impose cost differences because of differential resource requirements, as for example by imposing staffing requirements beyond those "necessary" to serve the actual patient mix. Therefore, it is appropriate to take explicit account of regulation and reimbursement practices.

A third, more general point is the following. Alternative techniques are available to nursing home operators for producing essentially the same output and may reflect, for example, differential opportunities for operating on the general cost curve facing all nursing homes. This can imply cost differences related to facility characteristics (e.g., age of facility) or other differences in the operation of the facility (e.g., percent of services contracted).

In summary, average operating cost is a function of output, input prices, regulation, and additional facility characteristics. A general cost function model can be portrayed as follows:

$$AOC = f(Q, P, R, F)$$

where AOC is average per diem operating costs

Q is vector of output produced by the facility;

P is a vector of input prices;

R is a vector of regulatory variables; and

F is a vector of additional facility characteristics describing production differences

Finally, it is important to remember that this study examines only the variation in operating costs as reported in the data sources available to the study. Capital costs were not included.[1] The dependent variable includes all expenses associated with payroll, fringe benefits, food, drugs, supplies, maintenance, laundry, contract services, utilities and other miscellaneous items. Excluded were property and profit taxes, depreciation, interest charges on outstanding debt, rent on plant or equipment, amortization of capital improvements, and profit.[2] This analysis must implicitly assume that capital costs are not substitutable for operating costs in the nursing home industry. However, to the extent that substitution exists between capital and operating costs or some costs are not properly accounted for in order to manipulate the rate, our results are weakened. The degree of substitution could not be explored in this study.

3.2 Factors Affecting Operating Costs

The potential cost factors falling into each of the above categories are discussed here and illustrative hypotheses indicated.

3.2.1 Input Prices

Where the prices of inputs are lower, all else equal, total operating cost will be lower, inasmuch as operating cost is the sum of the products of the prices paid for inputs and the quantities of inputs. Furthermore, providers will use different, less expensive input mixes in response to different relative prices. Such logic suggests the following hypothesis:

H_1: Providers located in market areas with higher input price levels will have higher costs.

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[1] Capital costs are difficult to measure accurately. Accounting data available here do not reflect true costs of capital.

[2] We believe the reported profit figures tend largely to be an accounting residual.

3.2.2 Scale of Production

A second type of variable that has been emphasized in previous studies (e.g. Skinner and Yett, 1973) is scale of production. The reasoning here is that firms which produce more output per unit time may be expected to have lower costs per unit of output, due to their ability to spread certain "lumpy" costs over more units, and due to other factors which produce economies of scale, like discounts for large input purchases or increased specialization by employees. On the other hand, a very large rate of output may lead to higher average cost, if large organizations incur expenses for communication and general management that small producers do not face. If there are decreasing average costs (i.e., economies of scale) over some low range for the rate of output and increasing average costs over some higher range, a minimum cost rate of output can be found.

The rate of output can be broken down into two parts: capacity to produce output, and the rate of utilization of capacity. Of course, the provider can produce no more output than his maximum capacity for a given time period. Average cost may decrease with increased utilization as operating costs associated with capacity (e.g., staffing, utilities, and administration cost for a facility of a given size) are spread over more and more units. Also, average cost may rise as limits to capacity are approached, since it may become more costly to manage and run a very full facility where staff and equipment are used as intensively as possible. Utilization (measured in terms of occupancy rates) may thus be separated from capacity, (measured in terms of average daily census or number of beds). Thus the hypotheses:

H_2: Average costs decline and then increase with the utilization rate.

H_3: Average costs decline and then increased with the capacity of the home.

In economic terms, it is hypothesized that the size and occupancy rate of a facility affects its costs, such that there are both economies of scale and utilization. Homes producing a larger output (e.g., a larger average daily census or a larger bedsize) have lower costs; and, at a given capacity, average cost declines as occupancy rates increase. These variables also allow for differences between the short- and long-run cost functions.

The occupancy variables also capture disequilibria deviations from the longer-run cost curve. Scale of production was represented by average daily census in the National and Indiana analyses, while the number of beds was used in the New York and Massachusetts analyses.[1]

3.2.3 Output Descriptors

It is important to recognize that patient days are not homogeneous. We have argued elsewhere (in Technical Papers T-1 and T-4) for viewing services provided as the major dimension of nursing home output and that patient descriptors (e.g., age) are not so important in themselves, but rather should be used in conjunction with information on the service intensity to assess whether or not the care provided is adequate--i.e., of appropriate quality. Costs thus vary directly with patient debility and other patient characteristics only insofar as facilities attempt to attain a similar level of quality. Unfortunately, direct measures of quality were not available. Service variables were taken as proxy measures for quality. However, it is important to realize that more services need not imply more quality.

H_4: Average costs are higher the more services are offered.

In other words, facilities providing more services can be presumed to use more resources and hence have higher costs. The relationship between services and "quality" is tenuous, for without explicit quality indicators, one cannot distinguish whether services are appropriate for patient mix. Nevertheless, direct measures of quality were not available.

Furthermore, if it is true that nursing homes "staff up" to offer those services appropriate to their case mix, then the intensity of services actually provided may not affect costs, given the patient mix. Thus, the alternative hypothesis is possible that,

H_{4A}: Average costs do not vary with respect to services actually provided, given measures of services offered and patient mix.

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[1] Average daily census (AD) is computed by dividing total yearly patient days by 365; the occupancy rate is computed by dividing total patient days by mean operating bedsize times 365. AD comes closer, in a theoretical sense, to a measure of output than a variable measuring bedsize of the facility. However, a reason for including size in beds is that this has been used as a grouping variable for rate setting in some states. AD and bedsize correlate so highly ($r = 0.9755$ in the national sample), that they are virtually identical. Both cannot be used in the same regression.

That is, as long as nursing homes "staff up" for a particular range of offered services which are appropriate to their case mix, then the intensity of services actually provided should not affect costs, given a particular patient mix.

Others (e.g., Skinner and Yett; 1970) have argued that patient mix belongs in the cost function and that patients vary in cost by age, diagnosis, and debility. That is, patient mix (e.g., health status, debility) also has an impact on cost, independent of services. Hence, the alternative hypothesis:

H_{4B}: Case mix measures have power to explain variation in average cost, holding service measure constant.

If, however, data on the adequacy or quality of care were available, our view of the interrelationship of quality, service intensity, and case mix would imply that once quality and case mix are known, the services necessary to care for that mix at that quality level are determined. This would imply that

H_5: Average cost varies systematically with case mix holding quality constant, and it varies with quality holding case mix constant.

In the New York analysis (Technical Paper T-5) we came closest to obtaining proxy measures of quality. Both interim and final ratings from survey certification inspections for 1976 were reported for each home in the sample. The ratings reflected the extent to which certification requirements had been met, thus allowing measures of the extent to which costs associated with certification were borne by the home. To the extent that certification assures the quality of care according to the perspective of the regulator, the rating variables corresponded to quality differences across facilities.[1] Still another factor which may be seen as describing the type of output produced is

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[1]Although the final ratings were available for 1976 we chose not to use them, both for theoretical and empirical reason. First, the final ratings, as distinguished from the initial ratings, reflect considerable negotiation, including negotiation of improvements or changes to be implemented in the future. Thus, the initial ratings should reflect more fairly the situation that prevailed during the course of the year. This was borne out by preliminary analyses that explored both alternatives. Only 0.8 percent of facilities were designated as needing improvement in the final overall rating. In the initial rating 7.6 percent of facilities received this designation and 0.2 percent were judged to be altogether unsatisfactory. Thus, we have used the initial ratings in the results reported here. There data were provided in "hard copy" by the New York State Department of Health.

case flow (i.e., a measure of the length of stay): facilities serving many patients for a short period of time may be seen as having a different case mix from homes serving few long-stay patients, although the total number of patient days may be the same. For example, a short-stay patient may require more intensive and rehabilitative care than a long-stay patient who is using more maintenance services. In addition, because increased case flow involves additional administrative work, homes with greater patient turnover are likely to have greater costs.

H_6: Average costs are higher the greater rate of turnover in the nursing home, i.e., the shorter the length of stay.

Put another way, increases in case flow increase the administrative burden of the home, and hence, it is hypothesized, positively affect costs. A variety of variables were available in each substudy. We use admissions per patient day in both the national and state analyses and the percentage of patients who are discharged dead as measures of case flow. Admissions per patient day is computed as the number of yearly admissions divided by total annual patient days; it can be shown that the coefficient of this variable estimates the fixed cost per admission.[1]

3.2.4 Facility Characteristics

Facility characteristics can be seen as indicating a facility's ability to operate at the lowest possible cost given its input prices, capacity, utilization and type of output. Facility characteristics reflect alternative methods for producing comparable output and may reflect, for example, managerial decisions and abilities. Ownership status--for profit, non-profit, or government--might,for example, be one of these. It is sometimes argued that non-profit homes are less cost conscious. This variable has also been widely used by regulators as an indicator that facilities are different for rate-setting purposes. One implication might be that rate setters believe the production process to differ by ownership. Such reasoning suggests the following kind of hypothesis:

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[1] Let AC = average cost; TC = total cost; x is a vector of explanatory variables, AD = admissions, and TPD = total patient days:

$$AC = a + \Sigma b_i x_i + b_n AD/TPD$$

$$TC = a\ TPD + \Sigma b_i x_i\ TPD + b_n AD$$

Therefore b_n is the addition to total cost of an additional admission, all else (including patient-days) constant.

H_7: For-profit facilities have lower average cost than non-profit and government facilities, all else constant.

Providers who are part of a nursing home chain, also may be able to provide care more inexpensively due to economies of joint purchasing and shared management.

3.2.5 Regulatory Variables

The proportion of patients by payment source indicates more information on the degree to which the facility is subject to regulatory restrictions. Thus, inclusion of patient payment proportions--e.g., the proportion of patients whose care is paid for by Medicaid--gauges the impact of these programs on the facility. Medicare is known to have the most stringent input standards. In addition, it is thought to have the most generous reimbursement mechanism, approaching full-cost retrospective reimbursement. These factors may encourage higher cost for both service and regulatory reasons. Thus, we have the illustrative hypothesis that:

H_8: The higher the proportion of Medicare patients, the higher will be average cost.

In most of the analyses, patient mix by payment source is controlled for by entering the percentage of Medicare patients and the percentage of private patients into the model.

In addition, certification of beds for Medicare entails that greater than average service must be available, whether or not the clinical "need" of Medicare patients require these services. Hence,

H_9: Medicare certification increases average cost.

In addition, homes certified as a Skilled Nursing Facility (SNF) are expected to have a greater service offering and intensity per bed than homes certified as an Intermediate Care Facility (ICF), and hence to have higher costs due to the differing regulations and requirements applicable to these two types of care.

H_{10}: Facilities providing only SNF care have higher average costs than those providing only ICF care.

Mixed facilities, having both SNF and ICF parts, are expected to have average costs intermediate between "pure" SNF and ICF facilities.

Private patients may expect more amenities and/or higher medical quality from nursing homes. On the other hand, private individuals purchasing care without government subsidy may be unable to demand and pay for higher quality care. On balance, we predict that the more important are private patients in the population served by the facility, the higher will be its service and amenity intensity. Private patients may demand more services, and hence have higher costs than public patients. Thus, we hypothesize that:

H_{11}: Not accounting for service intensity, average costs are higher where the proportion of private patients is higher.

Hypotheses H_8 through H_{11} argue that services vary by patient payment proportions. Models which include both payment proportions and adequate measures of service intensity may find that the service variables, rather than payment proportion capture variations in costs. Since the arguments concerning the effect of payment proportions rely on patient mix and the appropriateness of services to that mix, they suggest that case mix and services are the critical cost determinants given patient mix. It follows that payment mix does not affect average costs once account has been made for case mix and services, in which case we would have the following alternative hypothesis:

H_{11A}: Patient payment proportions do not affect costs, given measures of service variation.

Finally, it is important to hold constant differences in rate setting and other types of regulation across states, since these are expected to constrain the production possibilities of nursing homes and may also involve resource requirements. For the national study, a large variety of regulatory variables were available. We do not develop specific hypotheses here with respect to the cost impact of these variables. We merely confirm that it is important for the regulatory environment to be held constant.

H_{12}: Nursing home regulations have an impact on costs.

3.3 Empirical Specifications

To test the hypotheses presented in Section 3.2 it is necessary to postulate a functional form for the cost relationship (or to test several forms) and to define variables that measure the factors hypothesized to have an impact on cost--bearing in mind the practical limitations of data availability.

3.3.1 Functional Form

There is virtually an unlimited number of parametric or functional alternatives for analyzing the data. Two functional forms appear especially interesting. First and foremost is the linear form in which variables are assumed to affect costs in additive fashion, as shown below:

$$AOC = b_o + b_1 x_1 + b_2 x_2 + \ldots + b_n x_n$$

where AOC is average operating cost,

$x_1, x_2, \ldots x_n$ are the independent variables, and

$b_1, b_2, \ldots b_n$ are the coefficients to be estimated.

Potential nonlinearities can be encompassed by including them in quadratic form, or, as will be explained below, by assuming that the linear effect of a variable is different over different ranges.

Interpretation of the above form is straightforward. An increase in any variable x_i by one unit adds b_i dollars to average (per diem) cost. The linear form implies that the impact on average cost of a one-unit change in a variable is the same no matter what its level, and no matter what the level of the other variables.

A second form that emerges from production function literature is a multiplicative form:[1]

$$AOC = b_0 \cdot x_1^{b_1} \cdot x_2^{b_2} \cdot \ldots \cdot x_m^{b_m} \cdot e^{b_{m+1}x_{m+1}} \cdot \ldots \cdot e^{b_n x_n}$$

Here the first m variables to enter in a multiplicative fashion and variables m + 1 through n to enter exponentially. This form assumes not constant absolute changes for a one-unit change in a variable, but constant percentage changes: a one percent change in a variable x_i yields a b_i percent change in average cost for the first m variables. The variables treated in exponential fashion are generally zero-one dummy variables or proportions that take values ranging between zero to one and the coefficients show the multiplicative effect of the presence of a characteristic. This form can

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[1] See Lave and Lave (1970), and Nerlove (1966).

easily be fitted by converting the dependent variable and the first m independent variables to logarithms. Results reported below are ordinary least squares (OLS) results.[1]

3.3.2 Data and Variable Specification

The ability to test hypotheses is severely constrained if relevant information is not available or is believed to be inaccurate. In this section, the availability of variables from various data sets is discussed. To generalize, information on scale of production and certain facility characteristics (e.g., ownership, certification status) is quite complete across all substudies and is believed to be accurate. However, the availability of information on services, case mix, and quality differed significantly across the data sets and made the comparison of results very difficult. Furthermore, the general lack of explicit information on the quality of care presented a conspicuous omitted variable problem.

Cost analyses were conducted using data from a nationwide probability sample of nursing homes and all nursing home facilities submitting Medicaid Cost Reports in each of three states (Massachusetts, New York, and Indiana) for each of three years.

Data used in the national analysis came primarily from the 1973-74 National Nursing Home Survey conductd by the National Center for Health Statistics. This survey obtained information on the characteristics of

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[1] The basic premise behind the OLS regression analysis is that all firms operate on the same cost curve with the exception of a stochastic disturbance term which reflects purely random cost components (e.g., entrepreneurial vigor). With regard to technical statistical assumptions, it is assumed throughout that the disturbance term has zero mean and constant variance across observations, and also that disturbances across observations are uncorrelated with one another. Moreover, the matrix of independent variables is assumed to be nonsingular and uncorrelated with the error term.

2,118 nursing homes, including information on their costs, services provided, and the characteristics of their residents and staff. The data relate to calendar year 1972. There was no single, comprehensive source of regulatory/reimbursement data to adjust for differences in the regulatory environment across the states. As a result, data concerning the regulation of nursing homes were developed from a variety of secondary sources as discussed in Technical Paper T-4. Also included there is a full discussion of the NCHS data and data cleaning activities.

The basic source of data for the Massachusetts and New York analyses were the Medicaid Cost Reports for each nursing home. Although Medicaid Cost Reports had also been the original source of information in Indiana, only the county aggregates and averages were provided to us. The Massachusetts and Indiana data were for 1973 through 1975 and the New York data were for 1974 through 1976.

Of course, the data reflect the allocation conventions for accounting within each facility. Furthermore, it is possible that some facilities under-report costs which they know are not reimbursable and over-report in other categories.

As noted, New York cost data were supplemented with facility-specific certification inspection rating data (e.g., unsatisfactory, needs improvement, good). While the New York data contained information on home characteristics (e.g., for-profit status), Massachusetts cost data were supplemented with this information from a survey of facilities conducted each year by the Massachsuetts Department of Public Health. No facility or patient-specific data were available in Indiana. Further information on the state analyses can be found in Technical Papers 5 through 7.

Average retail wage data for the county of location was used in each analysis and came from the Area Resource File.

The code names and definitions of variables used in each analysis are contained in Tables 3-A.1 through 3-A.4 in Appendix A to this Chapter. The means and standard errors for variables in each substudy are reported in the appendices to Technical Papers T-4 through T-7. Below we examine the types of variables used in each substudy to proxy scale, services, case mix, case flow, regulatory factors, input prices, and other facility characteristics.

3.3.2.1 Output: Scale Effects

The effect of scale on average cost can be captured by using patient-days provided per unit time. Alternatively, a variable measuring capacity--number of beds--and a variable measuring the utilization rate for capacity--occupancy--can be used in combination. Because in some instances beds may be physically present but not actually available for use, some studies of hospital costs (see Feldstein, 1968) have used average daily census (ADC) as their measure of capacity. The national and Indiana analyses use average daily census in conjunction with the occupancy rate, omitting the number of beds. (Average occupancy rate is equal to the average daily census divided by number of beds, and so, given occupancy, the measures of average daily census and number of beds are close substitutes.) The number of beds and the occupancy were used in New York and Massachusetts analyses, for reasons to be explained later.

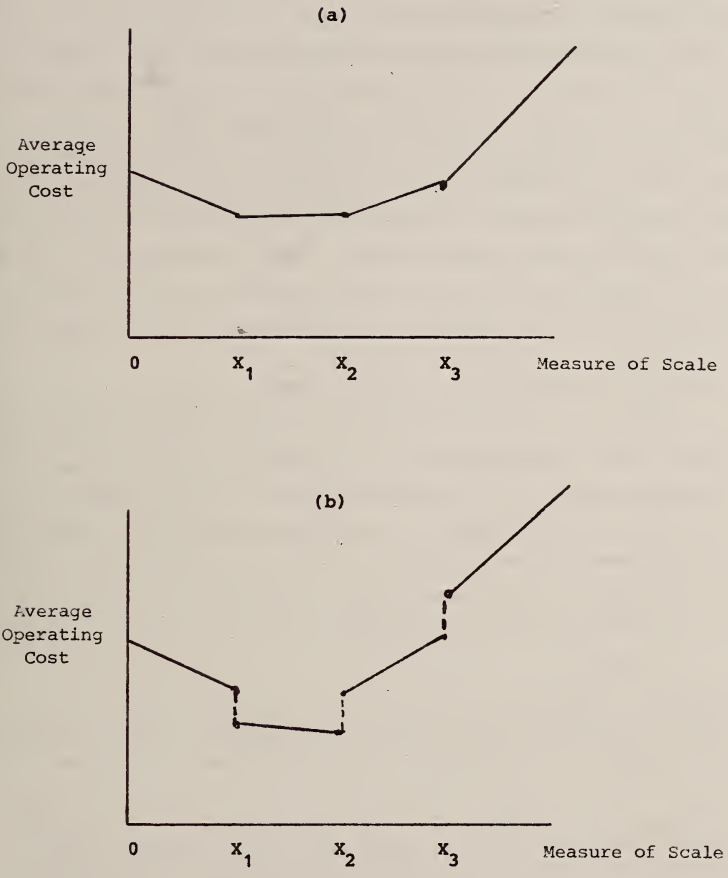
A "grafting" or piecewise regression technique was used to explore the possibility of differing impacts of bedsize, occupancy, or average daily census in alternative ranges. For this reason, the model is not strictly linear with respect to a few "key" variables. Much previous cost modeling--both with respect to nursing homes as well as hospitals--has been concerned with economies and diseconomies of scale and with potential non-linearities with respect to occupancy. Hence, it is desirable that the functional form of the average operating cost function be capable of testing the hypothesis of declining average costs as the output measure (average daily census) increases and as the occupancy rate increases. Such a formulation allows for a test of the existence of economies of scale and utilization. Rather than impose an arbitrary parametric form on the relationship of these variables, the model uses piece-wise estimation, called "grafting," for this purpose. This procedure, for the most part ignored within the literature, is perfectly general in the sense that it is empirically-based and permits the data to indicate a piece-wise linear approximation to an arbitrary, but unknown, functional form.[1]

Grafting technique to allow for non-linearities is accomplished by estimating separate linear segments over different ranges of the explanatory variable as shown in Figure 3-1(a). For example, if the explanatory variable in that figure were a scale factor and the dependent variable average operating cost, the results would indicate economies of scale between 0 and X_1, no

[1] For a general discussion of the advantages and application of this approach, see Fuller (1969).

Figure 3-1

ILLUSTRATION OF PIECE-WISE ESTIMATION



economies between X_1 and X_2, some diseconomies between X_2 and X_3 and substantial diseconomies above X_3. The technical derivation of this approach is presented in Technical Paper T-3 to this study.

Where the occupancy rate and the number of beds played a part in regulation (New York and Massachusetts), it made sense to directly coordinate the specifications. In the New York analysis a bedsize-cost relationship of the kind depicted in Figure 3-1(b) was explored. That is, in that analysis the effects of scale were examined separately over the different bedsize categories actually used by the state for grouping: 0-49, 50-99, 100-199, 200-299, 300+. It was hypothesized that a separate linear relationship between costs and the number of beds existed for each bedsize interval. The relevant groupings for rate setting in Massachusetts were facilities with 40 or fewer beds, and those with more than 40 beds. Separate scale effects were estimated for these groupings in the Massachusetts analysis. However, in this analysis the linear segments were constrained to be continuous at the interval join point (as shown in Figure 3-1(a)).

In the national and Indiana studies bedsize was not used as the measure of scale. In Indiana, bedsize did not enter into the rate determination process, while across the nation the relevant size categories differed across states. in some states size was not considered at all. Hence, for the national sample the variable used was the more generic term, average daily census.[1] The average daily census segments used in the national analysis were determined empirically, considering a variety of different ranges and selecting those that gave the most robust results.[2]

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[1] However, in preliminary analyses the beds variable was used and the results with respect to scale effects, coefficients on other explanatory variables, and overall explanatory power were virtually identical.

[2] Initially, 10 linear segments were grafted for the measure of average daily census. This allowed for determination of a set of join points sufficient to produce a similar approximation with a smaller number of grafted segments. After conducting a series of preliminary analyses, it was determined that six categories were sufficient. Investigating alternative join points resulted in the use of the following: 0-20; 21-40; 41-100; 101-150; 150-199; 200+. In Indiana, average daily census likewise was used, with empirically determined segments--0-39; 40-99; 100-149; 150-199; 200-249; 250+.

In each substudy occupancy effects were likewise explored over different intervals. In Massachusetts, there had been a penalty for facilities below 90 percent occupancy, and the Rate Setting Commission was considering raising the criterion level to 93, 95 or 97 percent. Hence, these segments were used in the Massachusetts analysis. Since neither New York nor Indiana imposed occupancy penalties, nor, as is obvious, is there a common occupancy category across the nation, the segments used in these analyses were selected by empirically considering a variety of ranges and selecting those which were most robust.[1]

3.3.2.2 Output: Services

The availability and intensity of services were measured less than perfectly in the data. Such measurement is most complete in the national analysis, with variables showing the presence or absence of seven services offered (e.g., occupational therapy), the percentage of patients receiving each of 12 services (e.g., nasal feeding, enema) in the previous week, as well as a summary measure of the number of services received by a patient in the last week.

The state data were more limited. The New York data included information on the number of doses of each of eight services provided to patients per year (e.g., prescriptions, radiation therapy), but only in the context of whether the service was included in the base Medicaid rate, not whether it was offered per se. The Massachusetts data were even weaker. The availability of services could be ascertained only by examining whether or not expenses had been reported in a service category or whether workers had been employed in the occupational category--and this only for physical therapy. No service data of any sort were available for Indiana.

An additional measure which may proxy amenity-type services is the proportion of patients in one-, two- or three- or more bed rooms. Data were available here for the national, New York, and Massachusetts analyses but not for Indiana.

Finally, as already noted, only in New York was there an explicit proxy measure of quality--namely, information on the certification ratings from inspection of the facilities (e.g., satisfactory, needs improvement). Both measures of quality are required before definitive answers on the impact of quality are possible.

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[1] In New York the selected occupancy percent ranges were 0-79; 80-89; 90-94; 95+; in Indiana they were 0-79; 80-84; 85-90; 90-92; 93-96; 96+; and for the national analysis they were 0-74; 75-84; 85-89; 90-92; 93-96; and 97+.

3.3.2.3 Output: Case Mix

While some patient sex and age data were available in all studies except that of Indiana, measures of patient debility and health status were not uniformly available. The most comprehensive data were available in the National analyses, including information on the level of patient dependence in six activities of daily living (e.g., grooming, walking), ten patient diagnoses (e.g., respiratory), and five categories of mental status (e.g., depression). However, patient mix measures in the national analysis were based on a sample of patients in each facility[1]; the size of the sample ranging from 1 to 10 patients. There, the patient mix data represented only an approximation to an actual characterization of the case mix in each home, so the patient related variables were subject to error.[2] Given this situation, one could expect that the regression coefficients for the patient mix variables in the national analysis were biased toward zero. That is, it was likely that the regression results understated the importance of case mix in determining costs. This presented a problem in interpreting the results since we could not reliably assess the role of case mix.

The previous econometric problem is dwarfed by the absense of quality specific data. Without quality data, there is no way to know what type of service or output is being produced. Since quality of care is related to patient mix and services provided, variations in quality mean that output is not held constant.[3] The presence of these two problems raises questions about the validity of patient mix coefficient interpretation in the national

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[1] The only exceptions were the payment source variables.

[2] The problem was actually that of "error-in-variables." Thus, least squares estimates of the regression parameters were biased and inconsistent, with the degree of bias and inconsistency being positively related to the variance of the measurement error.

[3] Independent of the errors-in-variables issue discussed in the prior footnote, the problem of omitted quality variables introduces bias and inconsistency into the model. Since patient mix and services are related to quality (which should properly enter the cost function), the coefficients of these variables will be both biased and inconsistent, with the degree of bias and inconsistency being a function of the correlation between quality and the patient and service mix variables.

analyses. Possible conclusions that the variables have little effect on costs cannot be drawn without some notion of the size of the patient mix-cost bias. Nonetheless, we used the patient mix measures in the national cost model because no other data were available. However, it should be noted that in the New York cost analyses where proxy quality measures were available and patient mix variables were for all patients in the home, patient mix indicators still were insignificant, suggesting that the errors-in-variables and absence of quality data problems in the national analysis should not be overemphasized.

There were fewer measures of patient debility in the New York data. For two years, there is data on the level of patient dependence in seven activities of daily living. In addition, for one year there is information on the level of patient impairment along five dimensions (e.g., alertness, hearing). No specific diagnostic data were available. In contrast, the Massachusetts data had much information on patient diagnosis; however, measures of dependence in activities of daily living were not available. For Indiana, no patient-specific information was available.

3.3.2.4 Case Flow

Variables representing turnover of patients might conceivably include admissions, type of discharge, or length-of-stay. As discussed in Technical Paper T-4, these variables are, in fact, non-linear combinations of each other, given other variables already in the model; to include all would lead to over-identifcation and estimation problems. The general reason for this concern is that length-of-stay is approximately equal to the number of admissions divided by patient-days, assuming that admissions are approximately equal to discharges and occur at a relatively stable rate. In brief, the measures of case flow used in the analyses were admissions per patient day and the percentage of patients discharged dead. In addition to being a mesure of case flow, the discharge death variable may conceivably reflect quality of care.

3.3.2.5 Regulatory Variables

Two types of regulatory variables were used. The first set, only used in the national analysis, was a vector of variables describing the regulatory and reimbursement environment for the state in which each

facility is located.[1] Since state regulations, such as certificate of need, vary across the nation, it is necessary to hold them constant in the cost model. The following state regulatory variables were included as dummy (0, 1) variables in the national analysis: presence or absence of certificate of need programs' occupancy limits; requirements for pre-admission patient assessments, life safety codes, uniform charts of accounts, payment limits, staffing requirements, and the means of reimbursement--prospective, flat rate, or cost-related.[2]

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[1] Data on state reimbursement and regulatory variables were abstracted from reports by Applied Management Sciences (April, 1976), Social and Rehabilitation Services (1973), the Urban Institute (N.D.), the General Accounting Office (1972), and Battelle (N.D.). For a discussion of these variables and sources, see the appendix to Technical Paper T-4.

[2] These terms are defined as follows. A prospective reimbursement system has a rate-setting mechanism in which the rate for an individual facility is determined prior to the period in question with no automatic retrospective adjustment. A flat rate system has a rate-setting mechanism in which the rate for a specific period is set at one level for a group of facilities. The rate may be negotiated, legislated, or established by a point system. In a cost-based reimbursement system, the rate for a specific period is determined during or after the period in question. It is typical to reimburse all allowable costs or, alternatively, to pay cost-related or actual cost rates.

The national model allows for the type of payment mechanism as follows. If the facility is in a state with a "cost related" reimbursement mechanism (e.g., whether it is "actual" or "retrospective" costs), then PM1 is set to 1, and 0 otherwise. If the facility is in a state with a "flat rate" system, then PM2 is set to 1, and 0 otherwise. Thus, the coefficients PM1 and PM2 relate the cost impact of reimbursement systems relative to the omitted category of "prospective" reimbursement. It was felt that the quality of the data was insufficient for identifying different forms of prospective reimbursement.

Also, in the national study, dummy (1,0) variables are used to indicate whether the facility is in a state with or without other types of regulations. The presence of certificate of need programs is indicated by CON; the presence of occupancy limits is indicated by OCCUPEN; the requirement of a pre-admission patient medical assessment is indicated by MA; the presence of life safety codes is indicated by LSC; the requirement of maintaining a uniform chart of accounts is indicated by UNIF; the presence of limits on administrative salaries and/or total payments is indicated by LIM; and the type of cost basis is indicated by CB, when the rates are set on an individual facility basis as opposed to some form of grouping. Finally, two types of staffing regulations are accounted for: the requirement that a registered nurse or licensed practical nurse be present irrespective of the size of the home is indicated by STAFFA; the number of nurses required per patient-day (adjusted for the number of SNF and ICF patients in the facility on the day shift) is indicated by STAFFB.

A more complete discussion of these variables is contained in Technical Paper T-4.

The second set of regulatory variables relate to cost variation within states. Included here are licensure and certificaton criteria such as Skilled Nursing Facility, Intermediate Care Facility, and joint SNF-ICF status. Also important is the proportion of patients who are Medicare or Medicaid beneficiaries. These variables were included because with more public patients in a facility, the facility is constrained by staffing and other input standards and rate regulations.

3.3.2.6 Input Prices

The basic input price variable for all analyses was an index of local wage levels, the average retail wage in the county in which the facility is located. In addition, dummy variables denoting SMSA/non-SMSA location and region were also included. A further price variable was available in the national and New York analyses, the average hourly nurse's wage within each facility. However, this variable may also reflect the quality of such labor inputs.

3.3.2.7 Other Facility Characteristics

This group of variables, the availability of which varies widely across the data sets, is meant to capture alternative techniques for producing the outputs. For the national and New York analyses, there was information on the percentage of costs contracted out. In Massachusetts, as well as the national analyses, there was information indicating whether the facility was part of a chain of nursing homes. Information on changes in bedsize was available for the national data. Information on the age of the facility was only available for New York. The national, Massachusetts and New York data contained information on for-profit/non-profit ownership status. None of these facility variables were available for Indiana.

3.3.3 Empirical Specification: Concluding Comments

It is clearly difficult to synthesize findings and compare results from analyses of these different data sets when each omits at least several critical variables. All the data sets have information on scale, capacity and utilization. Only New York data holds constant a very important aspect, quality of care; even there, questions can be raised about the reliability of the measure--i.e., facility certification ratings may reflect an inappropriate viewpoint of the inspector. The descriptors of patients and services are most complete for the national data set, with New York in a weak second place. Facility descriptors are generally available. Input price variation

is captured by county wage information, yet counties are much more meaningful market units in New York and Indiana than they are in Massachusetts. Regional dummies can also proxy input price variation, but when regions are used in rate setting, as in New York and Indiana, these dummies may also be seen as regulatory variables. While many variables are available in the national analysis to capture regulatory and rate-setting differences across states, questions can be raised about their accuracy and, more importantly, whether such variables are capable of capturing all of the relevant differences between states--e.g., regulations may be more or less stringently enforced.

At the outset, one can predict that fully satisfactory results are not possible from these limited data sets. The estimation of cost functions from such data nevertheless can give a partial analysis and suggest tentative answers. The discussion below focuses on the general significance and quantitative impact on cost of groups of variables rather than simply on the estimated coefficients of specific variables. An assessment of this kind also serves to focus attention on those areas where more attention should be given to data collection for purposes of avoiding potential omitted variable problems in development of operational reimbursement systems. (A complete discussion of the results from the national and individual state analyses can be found in Technical papers T-3 through T-7.)

3.4 The Results

3.4.1 Functional Form

The first issue to be resolved was the choice between the linear additive form and the multiplicative form, i.e., linear in logarithms. Both alternatives were explored using the national and Massachusetts data. Essentially, the same variables were significant in each parametric specification and explanatory power was virtually identical.[1] Since the additive

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[1] To investigate the comparative explanatory or predictive power of the two alternatives it is necessary to put the two equations on a comparable basis. This can be done by computing and squaring the deviations of actual operating expense from operating expense as predicted by the log equation (the antilog of the value predicted by the equation.) The sum of these squared residuals can then be compared to the sum of squared residuals from the linear form for the same data. The form which has the lower sum of squared residuals is deemed to be better.

For the national data set, the coefficient of determination (R^2) for the logarithmic form was 0.452, as compared to 0.462 for the linear form. For Massachusetts, using 1975 data, the R^2 for the log equation was 0.725 and for the additive it was 0.719. The actual regression results are presented in the Technical Papers.

form has more intuitive appeal and is easier to interpret, it was chosen as the one to be reported and used in the analyses for New York and Indiana.

However, the model was not strictly linear with respect to a few "key" variables. Much previous cost modeling--both with respect to nursing homes as well as hospitals--has been concerned with economies and diseconomies of scale and with potential non-linearities with respect to occupancy. As discussed earlier, rather than impose an arbitrary parametric form on the relationship of these variables, the model used piece-wise estimation, also called "grafting," for this purpose. This procedure is flexible in the sense that it is empirically-based and permits the data to indicate a piece-wise linear approximation to an arbitrary non linear functional form.[1] The technical derivation of this approach is discussed in Technical Paper T-3. The ranges for grafted segments were given above in Section 3.3.2

Another concern with regard to functional form was the necessity of estimating separate cost curves for each certification level, to evaluate whether homes providing different levels of care (SNFs, ICFs and combined SNF-ICFs) have different cost structures. If the individual skill-level cost curves were, in fact, different, then the estimation of a cost curve which used SNF, ICF and combined SNF-ICF homes in the same sample and allowed only intercept differences in the form of dummy variables for certification level would be inappropriate. Rather, separate cost curves would have to be estimated by certification level.

Such possibilities were explored in the analyses. There were no statistically significant difference in the cost functions between ICF and SNF facilities.[2] Hence, the hypothesis that cost functions were the same for differently certified nursing homes cannot be rejected. Thus, it is concluded that estimating a comprehensive cost equation, including homes of all certification types, is an appropriate approach.

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[1] Multi-collinearity is also a less serious concern with respect to this alternative. Preliminary results using a quadratic formulation were unreliable because of severe collinearity in the "occupancy" and "occupancy squared" terms (e.g., in the national analysis, r = 0.989) as well as "patient-days" and "patient-days squared" (e.g., in the national analysis, r = 0.909).

[2] In the national analysis, the F-statistic for the test of separate SNF, ICF, and SNF-ICF homes was 0.8267. This statistic is insignificant at the 0.05 confidence level, the critical criterion level being approximately 1.19. (See Technical Paper T-4 for details.)

3.4.2 Explanatory Power of the Cost Equations

The proportion of variation in per diem operating cost explained by the general types of variables discussed previously was remarkably similar across data sets despite differences in variable specification. The coefficients of variation (R^2) for the series of analyses are shown in Table 3-1.

Table 3-1: COEFFICIENT OF DETERMINATION (R^2) FOR PER DIEM OPERATING COST FUNCTIONS

	1972	1973	1974	1975	1976
National	0 .5847	-	-	-	-
New York	-	-	0.647	0.768	0.764
Massachusetts	-	0.656	0.713	0.719	-
Indiana	-	0.721	0.471	0.544	-

A meaningful proportion of the variation in operating expense has been explained in the cross-section studies, about 60 percent or more. However, it is clear that the accuracy and ability of the general estimation technique to predict average cost is much higher within individual states than it is in a national cross-section, despite the fact that national data were more complete in many respects. Inter-state variation in nursing home regulation may well be responsible for much of the variation in costs across states, and the regulatory variables used in the national estimates, though extensive, may not be complete enough to hold these effects constant.

3.4.3 The Coefficient Estimates

The actual coefficient estimates and significance levels are reported in the Appendix to this Chapter; the national results are in Table A.3-3 the New York results are in Table A.3-4, the Massachusetts results are in Table A.3-5, and the Indiana results are in Table A.3-6. (The variable definitions can be found in Table A.3-1 and A.3-2.) So-called "beta"

coefficients[1] are also given in these tables and in summary form in Table A.3-7 and are discussed where appropriate.

Because of data deficiencies, already discussed, and because of statistical multi-collinearity considerations, it is most useful to emphasize the overall significance and quantitative importance of groups (e.g., the service intensity variables, the input price variables, the patient mix variables, etc.) rather than focusing on the actual coefficients and significance obtained for individual variables. The findings with respect to particular variables may well reflect, at least in part, the effects of highly correlated omitted variables, or, in some instances, the effects of the presense of highly correlated variables within the model. Thus, entire groups of variables have been tested for statistical significance, using a residual F-test. These results are given in Table A.3-6.

Also, in an effort to ascertain the quantitative importance of entire groups of variables the beta coefficients of variables within each group have been added to give a weighted composite measure of the effect due to a single standard deviation change in all variables within the group (e.g., an increase of one standard deviation in all services). We turn now to the detailed results.

3.4.3.1 Summary of Results

The results presented in the remainder of this chapter describe which variables are significant in explaining cost variation in nursing home operating costs. How these results can be used in a rate setting process is the topic of Chapter 6. This section attempts to identify what has been learned from this econometric exercise, both in a methodological sense and in a statistical sense. To begin, there are four policy relevant findings that emerge from these results. They can be summarized as follows:

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[1]The beta coefficients are simply normalized regression coefficients and bear a straightforward relationship to the unnormalized regression coefficients, being equal to the unnormalized coefficient times the ratio of standard deviations for the independent (Sx) and dependent (Sy) variables:

$$b_x \cdot \frac{Sx}{Sy}$$

A beta coefficient of, say, 0.25 can be interpreted to mean that a one standard deviation change in the independent variable leads to a 0.25 standard deviation change in average operating costs, the dependent variable. Such coefficients are more appropriate for comparing parallel results from different analyses inasmuch as the data came from different years and average cost levels vary across states even within the same time period. In a sense, the beta coefficients scale the results from the different analyses to a common denominator. It is interesting to note that the beta coefficient for the independent variable in a bivariate regression model is identically equal to the simple correlation between the two variables.

- Regression analysis can successfully explain per diem cost variation.
- Better data on the patient mix and quality of care in nursing homes is needed.
- Variables explaining per diem nursing home operating costs behave as one would expect them to.
- The role of patient mix in determing cost variation cannot be ascertained with complete confidence given current data.
- The determinants of average per diem operating costs vary across the states.

Turning to the more specific types of inference that emerge from the analyses, the statistical results can be summarized as follows:

- The coefficient of determination (R^2) for a per diem operating cost model is between 0.471 and 0.768 for the majority of models explored here.
- When moving from a fully specified model to more limited one (where variables are entered only if their associated t-statistic is greater than 1), the same variables retain statistical significance and maintain their relative economic magnitude.
- Providers located in market areas with higher input prices and who pay a higher price for their inputs have higher costs.
- Although some returns to scale were found for homes in the lower ranges, in general, scale (or size) of facility had little impact on costs.
- Costs appear to be invariant with respect to occupancy.
- The instability of some of the Massachusetts and New York occupancy and size results across different years suggests that changing impacts of regulation on certain classes of facilities are perhaps more important than any underlying economies of scale and utilization.
- Services offered and provided do affect costs. In the more comprehensive national data, it appeared that services offered affected costs more than services provided, although this result was reversed in the less comprehensive New York data. In any event, definitive statements on service impacts must await better quality measures.
- Case mix measures (in particular, ADL and diagnostic variables), as a group, have some slight impact on costs, but the results are not consistent: ADL measures were not significant in the national analysis, but were significant in the New York analysis which also included a quality measure. Diagnosis, however, was significant in the national analysis. Moreover, individual coefficient estimates were confounded by multi-collinearity, the absence of quality data, and errors in variables. The finding is also consistent with the hypothesis that resources expended for a patient with given diagnoses, debilities, and impairments may differ widely across facilities, with the result that cost per patient day depends more on the facility's ongoing staffing level and target quality than on marginal changes in the mix of patients.

- Costs are higher, the greater is patient turnover, i.e., the admission rate.

- For-profit facilities have lower average per diem costs than non-profit and government homes. This result takes into account patient mix and output variation, to the extent allowed by the data; however, in the New York case after including a measure of for-profit facilities still had lower costs than non-profit facilities.

- Regulatory intervention clearly affects the structure of nursing home costs. The impact of licensure and certification is clearest in the large cost differentials between SNF and ICF homes, in all the analyses.

- Homes in states under prospective reimbursement appear to have higher average per diem operating costs than homes under flat rate or retrospective reimbursement systems.

- The impact of patient payment proportions varied across the data sets: in New York, facilities serving more private pay patients are less costly, while in Massachusetts, such facilities are more costly; the national findings are insignificant and again suggest that these results are averages across the states.[1] Similar contradictions between the state and national analyses were present with regard to Medicare patients. The state-specific regulations (e.g. type of reimbursement system) clearly have a large impact on costs and underline the importance of regulatory effects on home nursing home costs.

Taken together, these results highlight the conclusions which can be drawn when the cost models of the national and state samples are compared to one another.

In reading through the detailed discussions of the regression results reported in this chapter and in the supporting Technical Papers T-4 through T-7, the reader is reminded that these results provide only an example to be used in the development of a prototype cost related reimbursement system. The equation estimates are in no way absolute and must be reevaluated on a state-specific basis using data from homes in that state.

3.4.3.2 Scale Effects

The interest of rate setters in scale of production in nursing homes is evidenced by their use of bed size and occupancy information in setting rates. It has apparently been assumed by rate setters and earlier researchers that the scale of production for nursing home services has an impact on cost. This is shown by the use of size measured in beds as a grouping criterion and the use of occupancy floors. A residual F-test from

[1] An alternative explanation of the public-private patient cost involves a potential interaction of patient mix with size of home. Suppose only very large homes take public patients. Since the average size of homes in New York was significantly greater than in the other states, the public patient coefficient in New York would be expected to be more negative than in the other states, if public patients do cost more. Future studies should investigate the potential interaction of patient mix and facility size.

the national equation found that the scale of production did in fact add significantly to explanatory power. The F-test was significant for average daily census, but not for occupancy. The occupancy variables were also not significant in the state analyses.

When the national results are examined in more detail, it appears that the main effect of scale occurs at the lower end of the range for average daily census. There is a steep and significant decrease in the cost as average daily census increases from its lowest reported level to 20 patients per day--a decrease in per diem cost of around 20¢ per unit increase in average daily census--and a much smaller decrease for increases between 21 and 40 patients. Beyond 40 patients, the relationship between cost and census is virtually flat with little relationship, either positive or negative, between average cost and average daily census.[1] None of the occupancy variables achieve significance in the national analyses.

The New York and Massachusetts results generally corroborate the shape of the relatively flat relationship between cost and scale, with scale measured in beds. Costs decline gently over the lower ranges of size in beds, and then the relationship becomes insignificant and quantitatively not important. The only significant size variables are at the low end of the range. Actual dollar magnitudes are low. In Massachusetts, for homes with 80 or fewer beds, the decrease in average cost is a very gentle 2.7¢ per bed. The coefficient for bed sizes above 80 is extremely small and insignificant, indicating virtually no change in average cost as the number of beds increases above 80.

In one year (1976), the New York analysis also shows costs declining significantly as bed size increases in the smallest category of facilities, less than 50 beds. While the coefficient is relatively large, indicating a 10.2¢ decline in average cost for each bed added, it is not replicated in other years, and no other continuous size variables achieve significance. Indiana results for average daily census were insignificant.

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[1] There were approximately 50 homes in the 0-20 occupancy category and over 100 in the 21-40 occupancy category, thus this result is not an estimation artifact, i.e., due to the presence of just a few high cost homes in those intervals. It may be that the observed scale effects for small homes is due to recent changes in the size of the home. While a variable measuring change in bedsize was included, it may be an inadequate measure.

It is not surprising that there appears to be a flat relationship with regard to scale when one considers that the dependent variable, average operating costs, contains no "fixed" costs, i.e., costs such as rent on plant and equipment or property taxes. If fixed costs or even variable-plus-fixed costs were modeled as a function of capacity, it is more likely that significant economics of scale would be observed.

Further comments are in order with respect to size groupings that were used to classify facilities for rate setting purposes in New York and Massachusetts. Massachusetts estimates indicate that facilities in the two rate-relevant size classes (40 beds or less, and greater than 40 beds) did not differ in mean cost beyond what was shown by the continuous variables. In New York, however, size dummies entered the equations significantly, but in an erratic fashion across years. In 1974, facilities greater than 300 beds had average costs greater by $4.89 than other facilities. The class 100-200 beds was $1.12 more costly per patient day in 1975. The class 200 to 300 beds was $2.23 less costly in 1976. It is striking that these class indicators do not have a consistent pattern of impact on cost from year to year. Although this may reflect multi-collinearity problems with the estimation, it may also reflect the dynamic regulatory environment in New York state, with regulation and enforcement changing sharply from year to year. In this vein, the findings are consistent with the notion that year-to-year changes in rate setting can have an impact on the costs incurred.

The general response of average operating cost to the occupancy rate is negative for the national study, although no range is significant; as mentioned an F-test on the entire group of occupancy variables revealed that they were insignificant as a group for all analyses.

For New York, average cost appears to fall gently as occupancy approaches 90 percent in 1974 and 1975, and to fall over all ranges for 1976. No group of occupancy variables is statistically significant. In Massachusetts, where occupancy penalties affect the rate if occupancy is less than 90 percent, average costs fall significantly as occupancy rises to 90 percent. Because of the penalty, very few facilities operate at less than 90 percent, and those that do are apparently higher cost homes. Interestingly, the Massachusetts results tend to show an increase in average cost as occupancy increases above 95 percent. This appears to indicate higher cost per patient day as utilization approaches full capacity.

In brief, the state analyses have not found a technically stable relationship between cost and scale of production, (1) whether measured by average daily census or bed size, or (2) occupancy. The instability of the results for New York and Massachusetts suggest that the impacts of regulation on facilities are as important as underlying economies or diseconomies of scale and utilization. For the national analysis, which could not capture variation in state rate setters' treatment of size classes, size and utilization appear unimportant except for very small scale effects over the very low census ranges.

3.4.3.3 Output Descriptors: Services

Although information on the services received by patients, and the services available to them whether received or not, was not complete in the data sets, these variables in general did contribute to the explanatory power of the cost equation. Residual F-tests performed on the two data sets with relatively complete service information--the New York and national data--show that these variables are significant as a group.

In the national data it appears that services offered affected cost more than services provided; this result was reversed in the New York analysis. The variable distinction made between service availability--variables showing whether a service was offered in the facility--and services actually provided to patients--variable showing the number of "doses" of service given--is not consistent between New York and the national data set. The service types measured in the national data set are standard nursing services (e.g., bed bath, enema, intravenous feeding, etc.) while those for New York are more oriented toward diagnosis and rehabilitation by non-nursing personnel (e.g., number of X-rays, physical therapy sessions, inhalation therapy sessions, prescriptions). For the national data set, it appears that it is rehabilitation services rather than nursing services that have the greatest impact on costs, but a strong statement on this point should await a data set which includes information on services of both a rehabilitative and a standard nursing character.

In a larger context, one can ask whether the service vector measured by available variables is actually relevant to the main product provided by nursing homes: ongoing nursing and personal care of patients

who are not able to care for themselves. Special professional rehabilitation services and special nursing services may be added to this basic service package, adding to cost. Therefore, the presence or absence of special services must be held constant if cost variation is to be explained. But the availability of actual personnel contact hours for patients who need help with eating, dressing, and walking is not captured by the cost functions fitted here. Our theoretical approach argues that the appropriateness of services to patient mix determines the quality of care. Without a measure of quality to combine with patient descriptors, or a measure of service intensity along nursing and personal care dimensions, a key variable has been omitted.

In one year (1976), the New York analysis also shows costs declining significantly as bed size increases in the smallest category of facilities, less than 50 beds. While the coefficient is relatively large, indicating a 10.2¢ decline in average cost for each bed added, it is not replicated in other years, and no other continuous size variables achieve significance. Indiana results for average daily census were insignificant and economically very small.

Although the cost estimates can be used to indicate what a given bundle of services or level of care costs, further work is needed using requisite quality data, certainly prior to using cost analyses for setting rate formulae or screens.

The results with respect to the distribution of beds per room, a proxy measure for quality, are relatively consistent across states. The coefficients on variables representing privacy available to patients--the proportions of patients in single rooms, and in three or more bed rooms--indicate, as expected, that it costs more to provide care to patients in private rooms.

3.4.3.4 Output Descriptors: Case Mix

Patient descriptors are of four types: age, diagnosis, level of dependence in activities of daily living (ADL), and mental impairment. Patients may also be described by sex, but there is no a priori reason to expect a difference between women and men. Increases in the magnitude of the other variables can be hypothesized, in general, to correspond to increased dependence and need for care, and we therefore hypothesize that they also correspond to increased cost.

As noted earlier, the national data base had the largest array of patient descriptors. However, because the patient information there was based on a sample, each variable was subject to considerable error. The error would tend to bias the regression coefficients in the national equations toward zero, so that the conclusion that the variables have little effect should not be drawn without some notion of the size of the bias. The absense of quality data, as mentioned earlier, also had the effect of adding bias to the patient mix coefficient estimates. The reader is reminded to keep these considerations in mind in reading through the results below.

Age indicators, which might be expected to capture dependence that increases with age, were not found to add significantly to explanatory power in any of the data sets, as shown by consistently insignificant residual F-tests, although in Massachusetts in 1973 and 1974, those aged 90 or over were found to be significantly more costly to care for.

Measures of dependence in activities of daily living (ADL) when considered as a group, did not add significantly to explanatory power in the national equation, as found by the insignificance of the F-test.

The New York measures of ADL appear less complete but an F-test found that they did add significantly to explanatory power. Some indication of the magnitude of the effects of the significant variables may be of interest to readers, although since the group of variables are to some extent inter-correlated, individual coefficients may be unrepresentative. The significant variables all had the expected positive signs, such that a need for assistance added to cost. When the number of patients requiring assistance with eating rises by one percentage point, average cost increases 4.5¢ per patient day; a one percentage point increase in those requiring assistance with bathing raised cost 3.2¢ per day; and a need for assistance with correspondence added 2.3¢ per day for each percentage point in patient mix.

In the New York study, the patient and service mix data were the most complete. It should be remembered that New York is the only data set including a quality indicator. This lends credibility to the findings there. This result with respect to ADL measures in New York is consistent with the idea that cost is, in fact, associated with patient debility once quality is accounted for albeit crudely.

In New York for 1974, and in Massachusetts for 1974 and 1975, the only ADL related variable present was percentage of patients who were non-ambulatory, i.e., required assistance in moving about, and may not have been able to move about even with mechanical or human assistance. It is interesting that this crude patient status variable can apparently stand in for some aspects of patient care: the coefficients in all three cases were positive as expected for these more disabled patients, and similar in magnitude, 0.0334 for New York in 1974, and 0.0173 and 0.0212 for Massachusetts in 1974 and 1975 respectively. Thus increasing the proportion of nonambulatory patients by one percentage point appears to increase cost by between 1.5¢ and 3.5¢ per day.

Proportion female was never found to have a significant influence on average operating costs.

Variables representing patient mix by diagnosis were found to add significantly to the explantory power of the estimated equation for the national analysis, but not to do so in Massachusetts for which a very limited amount of diagnostic information was available. (New York and Indiana had no information on case mix by diagnosis.)

In summary, only a few types of patient status variables are significant in explaining cost, and the impact of particular variables is not consistent either across years or across data sets. As in the case of services, this may be due to problems of measurement. However, the finding of general insignificance is also consistent with the hypothesis that resources expended for a patient with given diagnoses, debility, and impairments differ widely across facilities. Cost per patient day depends more on the facility's ongoing staffing level and target level of quality which are set according to an anticipated mix of patients than on the actual services provided. The New York finding that ADL variables are significant, when quality is roughly accounted for, is consistent with this hypothesis. The reason for this is that for the same level of services and "quality" level, a more debilitated patient will be more costly to care for.

A comment is also in order with respect to the use of medical diagnoses to predict nursing home costs. Need for nursing and personal care may be assumed to depend more on a patient's ability to carry out

activities of daily living, and on the severity of conditions and impairments that require care, which may be caused by any of a number of medical or psychiatric diagnoses. The use of diagnoses to describe patient conditions or need is perhaps reasonable in an acute care setting, where each diagnosis may be seen as calling forth specific treatment resources. It is probably much less useful in a long term care setting, and its use reflects the pervasive influence of a medical approach to care for chronic patients.

3.4.3.5 Output Descriptors: Case Flow

The coefficients on the admissions per patient day variable can be compared across data sets if the reader bears in mind that different variables are "held constant" in each data set, and price levels differ somewhat across states and years. These coefficients show the addition to cost per admission, holding patient days provided constant, and holding constant all other available variables. As shown in Table 3-2, this cost was similar in order of magnitude across the data sets, falling between $250 and $450 whenever it is significant (with one exception). It is quite clear, in any event, that the admission rate is positively associated with cost, so that short-stay patients cost more to care for, all else constant, than long-stay patients.

Table 3-2: ESTIMATED COST PER ADMISSION

	National	Massachusetts	New York
1972	$419.33***	--	--
1973	--	$377.51***	--
1974	--	$262.37***	$ 342*
1975	--	$113.80	$1050**
1976	--	--	$ 276

*Significant at 0.10 level.
**Significant at 0.05 level.
***Significant at 0.01 level.

The explanatory power of these variables, as indicated by their beta coefficients, appears to be substantial (see Table 3-3). These standardized ratios are perhaps more useful in comparing the impact of a given variable.

Table 3-3: BETA COEFFICIENTS ON ADMISSION VARIABLE

	National	Massachusetts	New York
1972	0.2785		--
1973	--	0.2256	--
1974	--	0.1326	0.0763
1975	--	0.0554	0.332
1976	--	--	0.0316

3.4.3.6 Facility Characterization

Ownership

Ownership appears to have a significant impact on cost, even holding constant as many service and patient mix variables as possible. In all cases, government-operated facilities have the highest operating cost; operation by other nonprofit organizations is more costly than for-profit operation. The differences in magnitude between the estimated coefficients in the data sets of course may be due to omitted variables that are correlated with the ownership dummies so that the dummies pick up their effects. The national estimate, where explanatory variables are the richest, has the smallest difference in coefficients. Costs in for-profit homes were $2.50 less per patient day than government homes and $1.70 less than other non-profit homes. However, it should also be noted that regulation may play a large part here, as seen in the New York experience where the coefficients vary widely over the three years as did the regulations.

New York grouped facilities by ownership until 1976, so that non-profit facilities knew that at least the increment to average cost due to being non-profit would be recognized and paid by Medicaid.

Table 3-4: ESTIMATED COST ASSOCIATED WITH OWNERSHIP

ESTIMATED INCREMENTAL COST OF GOVERNMENT OVER FOR-PROFIT OWNERSHIP

	National	Massachusetts	New York
1972	$2.52***	--	--
1974	--	--	$ 9.43***
1975	--	--	$11.60***
1976	--	--	$10.30***

ESTIMATED INCREMENTAL COST OF NONPROFIT OVER FOR-PROFIT OWNERSHIP

	National	Massachusetts	New York
1972	$1.74***	--	--
1973	--	$3.58***	--
1974	--	$3.66***	$7.08***
1975	--	$2.73***	$5.96***
1976	--	--	$4.14***

*Significant at 0.10 level
**Significant at 0.05 level
***Significant at 0.01 level

This result implies that a non-profit facility had no incentive to cut costs as long as their costs were typical of non-profit providers. The cost differential between non-profit and for-profit homes fell between 1974 and 1975 but averages to $4.50. The cost increment of non-profit over for-profit status drops from $5.96 to $4.14 between 1975 and 1976. This decrease of around $1.80 in the non-profit/for-profit differential indicates the pressure placed on non-profit facilities by a new grouping scheme which did not treat them specially in 1976. The increment is still large--over $4.00 and shows an inability to adjust operating cost behavior totally in the short space of a year. It may also be due to the fact that cost containment incentives were blunted by the rate exceptions that were widely sought by non-profit homes.

The differentials in Massachusetts between non-profit and for-profit facilities--between $2.73 to $3.58--are relatively constant over the three years and lower than the differential among New York homes. For the years in question Massachusetts did not treat facilities differently by ownership for purposes of reimbursing operating costs.

Examining the estimated cost difference for these two state data sets leads to doubts about the meaning of the coefficients from the national data set, where of course the analysis averages the effect of rate regulation rules of states that recognize cost differences by ownership and of states that do not. It is difficult to argue that the national results show an actual cost differential by ownership due to systematic differences in the ability of various operators to minimize cost. It is more likely that these coefficients show a kind of average effect of varying state rate regulatory pressure put on different types of owners who optimize over different objective functions.

Other Facility Characteristics

Several other facility characteristics were available, but most were not significantly related to average operating cost. In both the national and New York data, contracting for services was positively associated with cost, but the estimates were not statistically significant. Operation of a facility as part of a chain had a negative but insignificant impact on cost in the national data. The Massachusetts analysis revealed that costs increased as the number of facilities in the chain rose to 13 and then decreased.[1]

3.4.3.7 Regulatory Effects

Regulatory variables used in these analyses are of two types, inter-state and intra-state. With regard to the first, it is clear that regulation expressed through rate setting, licensure, certificate of need, and utilization review vary from state to state. In order to find meaningful coefficients for other variables in a cost function based on national data, variation due to regulation must be accounted for.

The second type of regulatory variables, intra-state, are also directly relevant to explaining variation in facility operating experience. Such regulatory indicators show different regulatory interventions or effects

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[1] It is interesting to note that although the chain dummy variable was insignificant in the national analysis, the regional dummies were highly significant. Since most nursing home chains are located in the Southwest region, the omitted regional category, the significant location dummies may well be picking up a significant chain effect.

across facilities within a state. The effect of ownership, discussed above, was one such regulatory effect. A second is the impact of licensure and certification of beds, as Skilled Nursing Facility (SNF) beds, or Intermediate Care Facility (ICF) beds, or certification of beds for care to Medicare eligibles. Their regulatory impact affects the level of staffing and other inputs, since input standards must be sustained on an ongoing basis, whether beds are filled or not if licensure and certification are to be maintained. A different effect is hypothesized to take place through the mix of patients by payment source. In brief, the more dependent is a facility on public or Medicare patients, the more subject it is to rate setting regulations.

Impact of Licensure and Certification

Under federal regulations, homes with SNF beds must meet higher standards than homes with ICF beds. The impact of this difference is shown in all the analyses to be highly significant and large in absolute magnitude. Before discussing the results in detail, it is important to stress that differences in the impact of certification among states were expected for two reasons. First, states set the licensure and certification standards for nursing homes individually, and are restricted only within broad limits by federal regulations; the meaning of SNF-ICF level of care differentials vary across states. Second, as with the size groupings and the non-profit/for-profit distinction discussed above, certification status (i.e., SNF vs. ICF vs. mixed SNF-ICF) is used by states as a grouping criterion for rate setting. In fact, this is the only grouping criterion required under federal guidelines for state rate setting.[1] As argued above, when a criterion is used to group facilities, it is probable that cost differences between groups will be reinforced and perpetuated by grouping itself. Given an initial difference in average cost between the groups, a rate setting method relying on group means will set rates or rate ceilings that differ between the groups by about the amount of the initial average cost differences. There is no reason to expect that this difference should diminish over time, since on average it will be paid by the rate setting systems.

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[1] During the period in question federal regulations even required that SNF rates be higher than ICF rates.

The differences across states are shown by comparing results in Table 3-5 for New York, Massachusetts, and Indiana. The SNF-ICF differential in New York is one and a half to two times that in Massachusetts, and three-and-a-half to ten times that in Indiana. It should be kept in mind that there are price level differences embeded in the coefficients. However, a comparison of the beta coefficients reveal a similar result.[1] This result calls into question the usefulness of a national estimate which is so clearly the average impact of different state regulations, rather than a technically determined cost differential between varying well-defined types of care. The apparent differential between SNF and ICF care of $2.13 per patient day, found from the national data, must be seen as an average of widely differing state results, and should not be used to set rates in only a specific state.

Table 3-5: ESTIMATED DIFFERENTIAL COST OF SNF OVER ICF CERTIFIED FACILITIES

	National	Massachusetts	New York	Indiana
1972	$2.125***			
1973		$4.24***		$2.11
1974		$4.53***	$ 8.97***	$2.50
1975		$5.77***	$ 8.82***	$1.15
1976			$11.20***	

*Significant at .10 level
**Significant at .05 level
***Significant at .01 level

It is interesting to note in passing that the bed mix of facilities licensed to provide both SNF and ICF care was not well captured for any models but those of Massachusetts, and the results indicate that this may be important. For the national data, only dummies were used to indicate whether the facility was a pure SNF, ICF, or a mixed facility. The difference between the pure types is clearly significant with ICF facilities having

[1]The beta coefficient on the SNF variable for the nation was 0.130; for Massachusetts, it was 0.264; for New York it was 0.388; for Indiana, it was 0.097.

costs, but the dummy for mixed SNF-ICFs is not significantly different from the SNF coefficient (the omitted category). The New York data are for pure SNFs or ICFs only, but some of these are artificial distinctions. Costs were allocated by accounting rules to "distinct parts" in mixed facilities and reported as if they were for separate "pure" facilities. The coefficients are reported in Table 3-5 for New York for a variable distinguishing the type of care (HRF[1] or SNF). Interestingly, if the cost data are drawn from a part of a mixed facility (as shown by the variable "SNF-HRF" and "HRF-SNF" in the regression results presented in the Appendix), average costs are lower by between $1.72 to $1.79 in 1975 and by between $0.62 to $0.97 in 1976. Although only one of these coefficients is significant, these findings suggest that there are efficiencies to operating a mixed facility which accrue to both the SNF and ICF parts of the facility.

In Massachusetts, data are for facilities with bed proportions showing the mix of beds that are certified for Medicare, licensed for SNF care but not Medicare certified, and licensed as ICF beds (the omitted proportion).[2] The cost differential between SNF and ICF status increased from $4.24 in 1973 to $5.77 in 1975. In addition, a dummy was included in Massachusetts to pick up economies or diseconomies of mixing SNF, ICF, or rest home care types. Its coefficient was positive and significant, indicating, in contrast to the New York finding, that average costs are higher in facilities with mixed certification.[3] Rather than indicating diseconomies to mixed facilities, this may again show the impact of rate regulation. In comparing the magnitude of coefficients across the different analyses, one should again keep in mind differences due to price level variations. In Massachusetts rates were set for mixed facilities over the period studied using a weighted average of SNF and ICF ceilings. Each home was assigned a single rate which applied to all Medicaid patients, whether SNF or ICF.

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[1] New York uses the notation HRF--Health Related Facility--in place of ICF. The terms HRF and ICF are substitutes.

[2] Pure rest homes are not included in the sample, for consistency with the other data sets.

[3] This characteristic was estimated to add $1.09 to average cost in 1974 and $1.33 to average cost in 1975.

This could be expected to discourage cost control if facilities concentrated on public patients at the ICF level and private patients at the SNF level.

Payment Proportions

Payment proportions are treated as regulatory variables because the proportion "public pay" shows the impact on the facility of public rate regulation, and the proportion Medicare shows the importance of Medicare rate setting practices to the facility's costs and revenues.

Percent Private Pay

Theoretical investigation (see Technical Paper #1) led to the hypothesis that facilities oriented toward the private market might produce a different type of care, perhaps with a higher amenity level and commen-

Table 3-6: INCREMENT TO AVERAGE COST OF ONE PERCENTAGE POINT INCREASE OF PRIVATE PAY PATIENTS

	National	Massachusetts	New York	Indiana
1972	$0.0024	--	--	--
1973	--	0.0258***		-0.0072
1974	--	0.0455***	-0.0406*	-0.0172*
1975	--	0.0515***	-0.0364*	-0.0021
1976	--	--	-0.0618*	--

PERCENT PRIVATE PAY BETA COEFFICIENTS

	National	Massachusetts	New York	Indiana
1972	$0.0095	--	--	
1973	--	0.1072	--	-0.045
1974	--	0.2183	-0.119	-0.108
1975	--	0.2296	-0.0733	-0.012
1976	--	--	-0.121	--

*Significant at 0.10 level

**Significant at 0.05 level

***Significant at 0.01 level

surately greater costs than facilities serving mostly public patients. An alternative hypothesis is that private patients are more sensitive to price than public patients, and where rate setting for public patients is done on a full cost reimbursement, cost-pass-through basis, facilities serving more public patients will have higher costs. The national coefficient on the percentage of private pay patients, although positive and thus consistent with the first hypothesis is not statistically significant, and thus does little to confirm or deny either hypothesis.[1] The national impact of percent of patients who are private pay is statistically insignificant.

A residual F-test was conducted on the payment proportion variables for the national and Massachusetts analyses. Not surprisingly, in the national model, it was found that as a group, the payment proportions were insignificant. However, for the Massachusetts 1975 model, as a group, the proportions were significant.

A comparison of Massachusetts and New York results, however, reaffirms once more that the national cost function most likely averages the cost impact across states. (See Table 3-6.) It indeed appears that facilities serving more private patients are more costly on average than facilities serving public patients in Massachusetts; cost increases by 2.5¢ to 5¢ per patient day for each percentage point increase in commitment to the private market. This is consistent with the hypothesis that facilities oriented toward the private market offer more costly care. In contrast, New York facilities with a larger commitment to private pay patients are significantly less costly by about 3.5¢ to 6¢ per patient day for each percentage point increase in private pay patients. This is consistent with the hypothesis that facilities offer a less elaborate product or must be more cost-conscious when patients are paying for care with their own money. The statistical results imply that meeting these standards

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[1] A comment with respect to the interpretation of this coefficient may be useful here. While the impacts of various public-private patient mixes are perhaps well shown by the variable "percent private pay," it would be misleading to interpret this as showing the incremental cost of a private patient over a public patient in one facility. It may be assumed that public and private patients do not receive different care once they have been admitted to a facility; this may not be true if homes have separate public and private wings, but such practices are directly contrary to public policy, and are not allowed under certification regulations. Therefore the coefficient of percentage private pay is believed to proxy the commitment to the private market.

is costly and is offered as an explanation for the opposite direction of the effects in New York and Massachusetts. Again, questions are raised about the reliability of the cost function fitted for national data.

Percent Medicare Patients

Medicare pays for only a very small proportion of nursing home patient days. Medicare coverage is restricted to post-hospital care for patients with rehabilitation potential. Care provided is relatively intensive. It is not surprising that the empirical analyses show a significantly higher average cost for care as the proportion of Medicare days provided increases (see Table 3-7). The computed incremental cost of raising the percentage of Medicare patients served by one percentage point differs greatly between the two state analyses and the national results. Again this may be due to general price level differences across the samples used for the various analyses.

The Massachusetts data allow an attempt to tease apart the cost impact of maintaining a Medicare bed, whether filled with a Medicare patient or not, versus serving a Medicare patient. Some computation is necessary to make these findings comparable since proportion Medicare certified beds is not included in the New York or national analysis.

When combined with the coefficient for the impact of certification of beds under Medicare, the Massachusetts coefficient on the percentage of Medicare beds implies that filling a Medicare certified SNF bed with a Medicare patient is more costly than filling a standard Medicaid bed with a public patient. The increment to cost for a one percentage point increase in both Medicare beds and Medicare patients is 12.7¢ or 29.9¢ (for 1974 and 1975 respectively) for providing the care, and 4.0¢ and 3.2¢ for maintaining the bed. These figures sum to 16.6¢ and 34.1¢ per percentage point increase in Medicare patients. These results are close in order of magnitude to the New York figure but five to ten times the national figure. Again, this may be due to general price differences. While they are validated by the state results in their positive direction, it appears clear that states vary in their regulatory climate so that the differences between public, private, and Medicare expense and revenue is unlikely to be constant across states. It is not possible to place great reliance on the national coefficients, since it is hard to believe that they represent the actual increment to cost of increasing either Medicare, or private utilization.

Table 3-7: INCREMENT TO AVERAGE COST DUE TO MEDICARE UTILIZATION (AND CERTIFICATION)

	National	New York	Massachusetts[1]	
	Cost Per Percentage Increment In			
	Medicare Patients	Medicare Patients	Medicare Certified Beds	Medicare Patients
1972	$0.0324*	--	--	--
1973	--	--	--	$0.1460***
1974	--	$0.296***	$0.0397***	0.1267***
1975	--	$0.336***	$0.0319***	0.2988***
1976	--	$0.276***		
	BETA COEFFICIENTS, MEDICARE VARIABLES			
	National	New York	Massachusetts	
	Medicare Patients	Medicare Patients	Medicare Certified Beds	Medicare Patients
1972	$0.0466	--	--	--
1973	--	--	0.1643	--
1974	--	$0.121	0.1569	0.1841
1975	--	0.0939	0.2692	0.1241
1976	--	0.0851	--	--

*Significant at 0.10 level

**Significant at 0.05 level

***Significant at 0.01 level

[1] Unlike the New York and national analyses, the Massachusetts equation holds constant the proportion of beds certified for Medicare in 1974 and 1975 (and include a dummy for Medicare certification in 1973). This is useful because Medicare utilization has fallen greatly in recent years, although facilities have maintained certified beds; the coefficient answers the question, how much does utilization cost in addition to the cost of maintaining the capacity for Medicare utilization.

State Specific Regulatory Variables

The original reason for inclusion of regulatory variables was to hold these effects constant, rather than to test for the direction and magnitude of effects. If a regression equation is used to predict cost in some future rate setting system, one should see these variables as actively determined by regulators, rather than taken as given. The dynamic impact of these state-specific regulatory variables in considered is Technical Papers #3 and #8. The results below are meant to be only suggestive and are drawn from the regression results presented in the appendix.

Nursing homes in states with prospective reimbursement had higher costs by $1.40 per patient day than homes under cost-related or flat-rate reimbursement sytems. This result must be interpreted cautiously. A variety of explanations are possible. The result may be due to problems of equation specification and omitted variables (e.g., omission of correct quality measures). Alternatively, it may be that higher costs are associated with prospective systems for political reasons to get nursing home operator approval of a system that places them at risk to unforeseen events. Or, it may be that the cost ceilings used in retrospective systems are more cost constraining than the rates set under prospective reimbursement. Another explanation is that those states with excessively high nursing home costs adopted a prospective system in an effort to contain cost increases. A better test of the effect of prospective reimbursement would be to observe homes in both prospective and retrospective rate states over time. Nevertheless, the results do support those found by Sloan and Steinwald (1978) in an analysis of hospital costs that prospective reimbursement does not result in lower costs.

Other state regulations also appear to affect the costs of nursing homes. Homes in states with life-safety codes had statistically significant higher costs by about $0.75, as did homes in states which had an "absolute" staff requirement--i.e., required to staff an RN or LPN nurse irrespective of the size of the home--which had significantly higher costs by $1.45. Similarly, occupancy penalties significantly and positively affect cost. This result complements the earlier finding that there are few returns to higher levels of utilization and hence, states which penalize homes for low occupancy are apparently penalizing homes for what cannot be shown to be inefficient behavior. Several other regulatory variables, including the presence of a

certificate of need program, preadmission patient assessments, and uniform charts of accounts have positive but statistically insignificant cost impacts. Finally, reimbursement systems which put limits on total payments to nursing homes or put limits on administrative salaries may be successful in reducing costs. However, the negative coefficient was not statistically significant.

As was done for other groups of variables, a residual F-test was applied to the entire group of regulatory variables in the national model. The resulting statistic was highly significant, suggesting that such variables should be accounted for in a national cost modeling effort.

While the above discussion is suggestive about the "static" impact of regulation on costs, a more complete discussion must consider the "dynamic" impacts of how nursing home operators react to regulations, for the operators can alter their patient mix, occupancy rate, and services in response to regulation. The simultaneous multi-equation model of the nursing home industry (Technical Paper #8) considers the impact of regulation in this more appropriate dynamic context.

3.4.3.8. Input Prices

The level of input prices clearly affects operating costs. The index of regional wages levels, which was proxied by the average retail wage in the county in which the facility was located, was positively and significantly associated with the level of operating costs in the national and New York analysis. The county wage variable was not statistically significant in the Massachusetts analyses. The reason for the insignificance may be related to the fact that counties in Massachusetts are geometrically determined and much less compact than counties in other parts of the country. They do not correspond except in a general way to labor market areas since population density varies widely within each county.[1]

Another measure of input price variation was the geographic location of the home. In all cases, geographic region was significantly associated with operating costs. For example, in the national analyses, the per diem operating cost of homes in the Northeast was almost $4.00 greater than homes in the West; homes in the Central and South regions had costs around $2.00 more than homes in the West. Similar regional results were found for

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[1] Counties in Massachusetts form concentric circles around the Boston SMSA and do not form tight, meaningful geographic units.

homes in different areas of Massachusetts and New York. Another measure of geographic variation was SMSA/non-SMSA location. This measure was not statistically associated with cost differentials.

A final measure of input price, the average LPN wage within each facility, was available in the national and New York analyses. In both cases, this measure was positively and significantly related to operating costs. However, it is perhaps more correct to consider this variable as a measure of quality, since, ceteris paribus, higher paid staff may mean better quality inputs.[1]

3.5 Summary

The analyses reported here demonstrate the applicability of econometric cost modeling techniques to the nursing home industry. While the results do not directly translate into state-specific reimbursement formulae, they are useful in capturing the determinants of variation in per diem operating costs among both state-specific samples of and nursing homes. The conclusions developed here summarize the results presented above in the context of results found elsewhere. A comparison of our results with the other studies underlines the importance of the correct specification of nursing home cost models.

Optimal Size

Results here suggest that there are slight economies of scale up to an average daily census (or bed size) of 40 patients (or beds). Beyond that point, average operating costs appear insensitive to the number of patients (or beds).

Evidence in other studies on the effect of the size of nursing homes on costs is mixed, and may be attributable to (1) a definition of average costs which included fixed costs (e.g., rent, property tax), (2) incomplete specification of the variables or (3) absence of a "grafting" approach to size specification. The Moreland Commission (1976) found that size (measured by square footage of the institution) was the key determinant of cost. However, they did not control for either patient characteristics or services provided. Moreover, they measured size by using a measure of capital intensity which should not be entered in an operating cost equation;

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[1] It should be noted that when this variable was omitted from the regression the other estimated coefficients were virtually unaltered.

no measures of average daily census or bed size were reported. Ruchlin (1972) found that size (measured by patient days) was not significantly related to average cost; the estimated coefficients were statistically insignificant and produced the counter-intuitive result that costs increased at first, and then decreased with increases in patient-days--a cost curve with an inverted U shape.[1] Again, services offered were omitted, as well as patient characteristics except for payment mechanism. Skinner and Yett (1970), too, found a disparate set of results. Using beds as a measure of output, they too found an inverted U shape, though not statistically significant. With a patient day measure of output, they found that costs increased monotonically. Using a model which included both patient stock (number of cases) and patient flow (total bed days), the estimated cost curve had a very flat U shape, with a minimum around 85 beds. In general, they seem to conclude that the cost curve can best be described as having a very shallow "saucer" shape, a result in line with those found here. Skinner and Yett pointed out the possibilities for misspecification and multi-collinearity in their results;[2] moreover, they too omitted services offered, as well as input prices. The AMS (1976) study concluded that bed size was positively related to costs; their final equation entered only "bedsize greater than 60"; this variable raised costs by $1.50. Because AMS defined per patient cost in terms of the rate charged to private patients, the relation of this result to the others is not clear.

Occupancy

Results across all national and state analyses found no occupancy effect. Elsewhere, Ruchlin as well as Skinner and Yett entered the occupancy rate in a linear fashion and found that it was negatively related to cost, but did not discuss economies or diseconomies of utilization. In their final result, AMS entered only the single term "occupancy rate over 93 percent." The difference in results may be due to omitted variables in the other studies. Skinner and Yett used state-specific data for California which may also account for their contrary finding.

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[1] Cost equations results for the individual components of operating cost in the national analysis (e.g., laundry, food, etc.) did produce U shaped cost curves. See Technical Paper #4.

[2] In the national data used for this paper the correlation between patient-days and patient-days squared was 0.909.

Patient Mix

It is widely believed that patient mix affects nursing home costs. Little evidence was found here for such effects. As stressed throughout the text, data limitations, particularly the absence of adequate quality and patient mix measures most likely had a critical effect on these results. Patient mix did not appear as a very significant determinant of cost in the national and Massachusetts analyses. Yet such a result seems counter-intuitive. Two explanations, discussed earlier, were (1) that quality was not held constant and (2) the data were subjected to measurement error. Support for this explanation comes from the New York results, which did include crude measures of quality and where patient mix was a significant cost factor. In addition neither average age nor percent female affected costs.[1]

With regard to patient health status, results here found that per diem cost was, for the most part, unrelated to diagnosis, mental condition, or measures of debility--after controlling for services offered. Of course, if all the patients in a home did have those characteristics which were statistically significant, the cost impact could be large. However, an analysis of the average effect of patient characteristics (see Technical Paper #4) suggested that the maximum effect was on the order of 6-11 percent of average per diem costs. This result is in contrast with the Skinner and Yett finding that partially debilitated patients cost more than either independent or dependent patients;[2] however, the Moreland Commission found that ambulatory/non-ambulatory status was not a significant factor and concluded that cost variation had nothing to do with patient need.

In light of our findings for the New York (where quality measures were present), we maintain that there are certain types of data such as patient mix, that should be considered by ratesetters, even though they have not been shown as significant throughout all of our analyses. Furthermore, we have cautioned against the use of particular variables (e.g., picking only

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[1]Neither Ruchlin nor AMS report age variation; AMS reported sex as insignificant. Skinner and Yett found that average age negatively affected costs and percent female positively affected cost.

[2]AMS found that while partially debilitated patients cost more than independent patients, totally debilitated patients cost the most.

those patient descriptors that are significant) to measure cost impact. The reasons are that the patient descriptors vary as a group, and multi-collinearity may have caused one or another variable to appear significant. It is clear that better data are necessary to capture the effects of particular variables.

Services

A major finding was the impact of services offered on cost (see Technical Paper #4). That the intensity of service use was not significant suggests that costs vary with the absolute availability of services, rather than their relative use. Only the AMS study allowed explicitly for services offered; these variables were related to their proxy measure of cost, private price.

Input Prices

As found elsewhere, input prices were positively related to average operating costs.

Regulations

Little is known about the effect of regulations on nursing homes, aside from the JWK (1976) simulation of SNF/ICF operations standards. Also, Ruchlin's study of Massachusetts homes over the period 1965-1969 found that alterations in reimbursement procedures were related to costs.

Results here suggest that there is a definite relationship between regulations and inter-state nursing home costs. However, the relationship is complex and warrants more investigation, as is seen in the coefficients of the reimbursement type variables. For example, the multi-equation results discussed in the next chapter suggest that the positive association of prospective rate systems (as opposed to cost-based or flat-rate systems) with higher costs may be due to increased provision of services; while prospective rate systems may cause higher costs--for example, if facility operators require a risk premium, or if administrative costs are higher--results here may also reflect a historical phenomenon--high cost states are likely to be most responsive to new techniques to contain these costs. Further study of the effect of alternative reimbursement systems is needed. Other regulatory variables were also associated with costs differentials; staffing and occupancy requirements were positively related to costs, while payment limits may reduce costs. Similarly, licensure (SNF/ICF) status (which may also be

considered a proxy for services offered and patient condition) was found to affect costs in the state as well as the national analyses.

Finally, it is widely believed that private patients pay higher rates for nursing home care than do public patients. This is commonly transformed into an assumption that private patients cost more than public patients. This hypothesis was supported by the Massachusetts results while the national study neither supported or rejected it. Both Skinner and Yett as well as Ruchlin found that private patients cost more than public patients.

3.6 After Thoughts

It is important to reiterate that the results of the national analysis reflect "average" impacts across the states and regions. It is clear from the state analyses that cost determinants vary widely across the nation. Thus, the Massachusetts and New York analyses found that certain coefficients differed widely in statistical significance, sign, and magnitude. Yet these two states, in many respects, are somewhat similar in their regulatory attributes (see Technical Papers #5 and #6). A comparison of results, if data were available, from states with very different regulatory environments like Utah or Illinois, would result, most likely, in even more striking differences. While the national data are more comprehensive in that they contain more information on the impact of production variables like patient characteristics, these data are confounded by variation in cost-related aspects that are really irrelevant to nursing home production in a technological sense. Much of the variation in the national data apparently is not caused by variation in nursing home production so much as it is caused by variation across states and the way facilities are regulated. A priori, we suspect that the factor leading to the largest amount of variability across the states is the way quality standards are maintained. Without a way to hold quality constant, there is no assurance that ICF care in one place is the same as ICF care elsewhere. Moreover, the impact of patient mix and services may be incorrectly measured as well without adequate measures of quality. We emphasize again that more service does not necessarily mean more quality. Rather, it is important to have services appropriate to case mix. That may mean more services than we have now in many cases, but it also may mean less for some case mixes.

APPENDIX 3-A

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Table 3-A.1

VARIABLE DEFINITIONS: NATIONAL ANALYSIS

AOC	Operating costs per patient day, i.e., all annual non-capital costs per patient day that could be avoided only by completely closing the nursing home divided by the number of annual patient days provided
AD	Patient days provided in 365 day units, i.e., average daily census
OC	Percentage of beds occupied by patients
AGE	Average age of patients in the home
FEMALE	Percentage of female residents on night prior to the survey
Diagnosis	
ARTERY	Percentage of patients with diagnosis: hardening of the arteries
MENTAL	Percentage of patients with diagnosis: mental disorders (e.g., mental retardation, psychoses, neuroses, mental illness, emotional problems
STROKE	Percentage of patients with diagnosis: stroke
ACCIDENT	Percentage of patients with diagnosis: accidents, poisonings, and violence
NUTRIT	Percentage of patients with diagnosis: endocrine, nutritional, and metabolic diseases
OLD	Percentage of patients with diagnosis: senility, old age, and other ill-defined conditions
RESPIRAT	Percentage of patients with diagnosis: respiratory system
DIGEST	Percentage of patients with diagnosis: diseases of the digestive system
NEOPLASM	Percentage of patients with diagnosis: neoplasm
HEART	Percentage of patients with diagnosis: heart attack

Mental Status

DEPRESS	Percentage of patients/depressed
NERVOUS	Percentage of patients/agitated and aggressive
ABUSE	Percentage of patients/abusive and aggressive
SENILE	Percentage of patients confused or senile
SLEEP	Percentage of patients with disturbed sleep

Activities of Daily Living

GROOMPD	Percentage of patients who need help in getting and/or putting away equipment or who need help with bathing but can wash face and hands, brush teeth, comb hair, and shave or apply makeup
GROOMD	Percentage of patients who need help in at least two of the following activities: washing face and hands, brushing teeth or dentures, combing hair, and shaving or applying makeup
DRESSPD	Percentage of patients who need partial assistance in dressing
DRESSD	Percentage of patients who stay partly or completely undressed
EATPD	Percentage of patients needing major assistance to eat
EATD	Percentage of patients receiving either intravenous feeding or tube feeding
WALKPD	Percentage of patients receiving nurses' assistance in going to the toilet room (do not count on use of cane, walker, or other object of support), using bedpan or commode at night, or cleaning self or arranging clothes after elimination
WALKD	Percentage of patients unable to go to the toilet room for the elimination process
BEDPD	Percentage of patients who need assistance on moving in and out of a bed or chair
BEDD	Percentage of patients who are bedfast
CONTINPD	Percentage of patients who are in control of bladder only or bowels only
CONTIND	Percentage of patients who are not in control of bowel and bladder

Output: Services

OT	1 = Occupational therapy offered on premises 0 = Otherwise
RT	1 = Recreational therapy offered on premises 0 = Otherwise
REHAB	1 = Rehabilitation services other than those indicated by PT, OT, RT, SPHT, or COUNSEL are offered on premises 0 = Otherwise
EDUC	1 = Presense of an educational program 0 = Otherwise
PT	1 = Physical therapy offered on premises 0 = Otherwise
SPHT	1 = Speech and hearing therapy offered 0 = Otherwise
COUNSEL	1 = Counseling by social worker, psychologist, or mental health worker offered 0 = Otherwise
NASAL	Percentage of patients in the past seven days receiving nasal feeding
BLOOD	Percentage of patients in the past seven days receiving blood pressure reading
ENEMA	Percentage of patients in the past seven days receiving enema
CATH	Percentage of patients in the past seven days receiving catheterization
BATH	Percentage of patients in the past seven days receiving full bed bath
BOWEL	Percentage of patients in the past seven days receiving bowel and bladder retraining
OXYGEN	Percentage of patients in the past seven days receiving oxygen therapy
BAND	Percentage of patients in the past seven days receiving application of dressing or bandage

PULSE — Percentage of patients in the past seven days receiving temperature-pulse respiration

HYPO — Percentage of patients in the past seven days receiving hypodermic injection

IRRIG — Percentage of patients in the past seven days receiving irrigation

INTRAV — Percentage of patients in the past seven days receiving intravenous injection

SUMSER — Average number of services received per patient per month where the services examined include PT, RT, OT, REHAB, SPHT, and COUNSEL

PONEB — Percentage of rooms with one bed

PTHREEB — Percentage of rooms with three beds

Output: Case Flow

ADMISPD — Number of patients admitted in 1972 divided by annual patient days

DEATH — The number of patient deaths in 1972 divided by the census on the night prior to survey

Input Prices

RETAILWG — 1973 average retail wage in the nursing home's county (taken from Area Resource File)

NURSEWG — Average wage of housekeeping and maintenance personnel (maid, laundryman, maintenance man, etc.) in the home

SMSA — 1 = Not located in SMSA
0 = Located in SMSA

Regulatory Variables

ICF — 1 = Type of certification is ICF only
0 = Otherwise

ICF-SNF — 1 = Type of certification is Medicare & ICF, SNF & ICF, or Medicare, SNF, & ICF
0 = Otherwise

PCTPRI — Percentage of patients whose primary source of payment is own income or family support (private plans, retirement funds, social security, etc.)

PCTCARE — Percentage of patients whose primary payment source is Medicare (Title XVIII)

PM1 — 1 = Type of payment mechanism was cost related (either reasonable, actual, or retrospective)

PM2 — 0 = Otherwise
1 = Type of payment mechanism was flat rate (incl. pts.)
0 = Otherwise

CON — Indicates status of the Certificate of Need Program
1 = Functioning 1972
0 = Not functioning

LSC — Life Safety Codes were in effect in 1972
1 = Yes
0 = No

LIM — Indicates presence of absolute limits on administratiave salaries and/or payments
1 = Yes
0 = No

STAFFA — Indicates the requirement that an RN or LPN be present irrespective of the size of the home
1 = Yes
0 = No

STAFFB — Number of nurses required per (SNF/ICF adjusted) patient day for the day shift

MA — Indicates time of patient assessment relative to admission
1 = Pre
0 = Post

UNIF — Indicates the requirement of maintaing a uniform chart of accounts
1 = Yes
0 = No

CB — Indicates type of cost basis (AMS)
1 = Individual facilities
0 = Groups

OCCUPEN — Indicates presence of occupancy penalties
1 = Yes
0 = No

NORTHEAST — 1 = Northeast location
0 = Otherwise

CENTRAL — 1 = Northcentral location
0 = Otherwise

SOUTH — 1 = Southern location
0 = Otherwise

Facility Characteristics

PROFIT — 1 = Individual, partnership, or corporate ownership
0 = Otherwise

NONPROFIT — 1 = Church-related or nonprofit corporate ownership
0 = Otherwise

CHANGE — 1 = Bed size of home changed in past 12 months
0 = Otherwise

CHAIN — If the home is not government owned, this variable indicates whether facility is a member of a group of homes operating under one general authority or general ownership
1 = Yes
0 = No

PCONTRACT — Percentage of operating costs met by contracting with outside group

PAYEXP — Total payroll expenses per patient day

NUREXP — Nursing staff payroll expenses per patient day (includes RNs, LPNs, practical nurses, aides, orderlies, student nurses, and other nursing staff)

FOOD — Outlays for food and other dietary items (include non-contracted services only) per patient day

MAINT — Outlays for purchased maintenance of buildings, grounds, and equipment per patient day

LAUN — Laundry and linen expense (include non-contracted services only) per patient day

COOKWG — Average wage across dietitians, nutritionists, and food service personnel (cook, kitchen help, etc.) in the home

Table 3-A.2

VARIABLE DEFINITIONS: NEW YORK ANALYSIS

OUTPUT CHARACTERISTICS

Scale (bed-size variables for piece-wise estimation)

BEDS 1	Bed-size segment defined over 0-49 bed interval, (i) equal to the central number of beds if 49 or fewer and (ii) equal to 49 if more than 49.
BEDS 2	Bed-size segment defined over the 50-99 bed interval, (i) equal to zero if actual number of beds is fewer than 50, (ii) equal to actual number of beds minus 49 if bed size ranges between 50 and 99, and (iii) equal to 49 if number of beds is more than 99.
BEDS 3	Bed-size segment defined over the 100-199 bed interval, (i) equal to zero if number of beds is fewer than 100, (ii) equal to number of beds minus 99 if bed size ranges between 100 and 199, and (iii) equal to 100 if number of beds is more than 199.
BEDS 4	Bed-size segment defined over the 200-299 bed interval, (i) equal to zero if number of beds is fewer than 200, (ii) equal to number of beds minus 199 if bed size ranges between 200 and 299 and (iii) equal to 100 if number of beds is more than 299.
BEDS 5	Bed-size segment defined over the 300+ bed interval, (i) equal to zero if number of beds is fewer than 300 and (ii) equal to number of beds minus 299 if bed size is more 300 or more.

Patient Age Distribution
(percentage aged
65 to 74 omitted)

% UNDER 65	Percent of patients under the age of 65.
% AGE 75 to 84	Percent of patients aged 75 to 84.
% OVER 84	Percent of patients over the age of 84.
% FEMALE	Percent female patients.

Patient Ambulatory States Variables

% WALK	Percent of patients requiring either partially or total assistance with walking.
% EAT	Percent of patients requiring either partially or total assistance with eating.
% BATHE	Percent of patients requiring either partially or total assistance with bathing.

VARIABLE DEFINITIONS: NEW YORK ANALYSIS (Cont'd)

% BREATHE	Percent of patients requiring either partially or total assistance with breathing.
% DRESS	Percent of patients requiring either partially or total assistance with dressing.
% CORRESPOND	Percent of patients requiring either partially or total assistance with correspondence.
% MEDICATE	Percent of patients requiring either partially or total assistance with medication.
% MASSAGE	Percent of patients requiring either partially or total assistance with massage.

Patient Impairment Variables

% ALERT	Percent of patients either partially or totally non-alert.
% SEE	Percent of patients having either partial or total impairment of sight.
% HEAR	Percent of patients having either partial or total impairment of hearing.
% SPEAK	Percent of patients having either partial or total impairment of speech.
% COMMUNICATION	Percent of patients having either partial or total impairment of communication.
% DEATH	Annual death rate as a percentage of average daily census.
ADMRATE	Ratio of total annual admissions to total annual patient days.

Service Offerings--Dummy variables indicating:

DRUG	Cost of drugs is included in the fianancial statment.
PHYS/THERAPY	Physical therapy is provided to medical patients and its cost is included in the financial statement.
OCC/THERAPY	Occupational therapy is provided to medical patients and its cost is included in the financial statement.
SPEECH THERAPY	Speech therapy is provided to medical patients and its cost is included in the financial statement.
SPECIAL DUTY	Special duty nursing is provided to medical patients and its cost is included in the financial statement.
PHYS. SERVICES	Physical services are provided to medical patients and its cost is included in the financial statement.

VARIABLE DEFINITIONS: NEW YORK ANALYSIS (Cont'd.)

OTHER SERVICES	An index measure of other service offerings equal to the number of following services, provided to Medicaid patients and included in the financial statement: (i) dental services, (ii) oxygen, (iii) audiology and, (iv) podiatry

Service Intensity

#PRESCRIP-TIONS	Average annual number of pharmacy prescriptions per patient
#X-RAYS	Average annual number of x-rays per patient
#PHYSICAL THERAPY	Number of patients receiving physical therapy
#SPEECH THERAPY	Number of patients receiving speech therapy
#OCC THERAPY	Number of patients receiving occupational therapy
#INHAL THERAPY	Number of patients receiving inhalation therapy
#RADIATION THERAPY	Number of patients receiving radiation therapy
#SOC SERVICES	Number of patients receiving social services

Bedroom Distribution (percentage of patients in 2-bed rooms omitted)

%1BED	Percent of patients in 1-bed rooms
%3BED	Percent of patients in 3-or more bed rooms

INPUT PRICE VARIABLES

LPN WAGE	Average LPN wage within facility
RETAIL WAGE	Average county-wide retail wages
POPDEN	County-wide population density

REGULATORY-TYPE VARIABLES

HRF	Dummy variable identifying Health Related Facilities (SNF omitted)

VARIABLE DEFINITIONS: NEW YORK ANALYSIS (Cont'd.)

Sponsorship (public sponsorship omitted)

PROFIT	Dummy variable identifying for-profit facilities
NONPROFIT	Dummy variable identifying non-profit facilities

Pay or Distribution (percentage Medicaid omitted)

%PRIVATE	Percent private pay patients
%MEDICARE	Percent Medicare patients

Survey Certification Ratings ("good" voting omitted)

NI	Dummy variable indicating "needs improvement" rating
DEFERRED	Dummy variable indicating voting deferred
#UR	Number of utilization review cases divided by average daily census

Bed-Size Categories--Dummy variables indicating:

SIZE1 (omitted)	0-49 beds
SIZE2	50 to 99 beds
SIZE3	100 to 199 beds
SIZE4	200 to 299 beds
SIZE5	300 or more beds

Regions--Dummy variables indicating:

REGION1 (omitted)	West
REGION2	Rochester
REGION3	Central
REGION4	Northeast
REGION5	North Metropolitan
REGION6	Long Island
REGION7	New York City

VARIABLE DEFINITIONS: NEW YORK ANALYSIS (Cont'd.)

TECHNOLOGY OR PRODUCTION PROCESS VARIABLES

SNF-HRF	Dummy variables indicating SNF part of a combined facility
HRF-SNF	Dummy variable indicating HRF part of a combined facility
CLINIC	Dummy variable identifying facilities with a clinic
%CONTRACT	Percent of operating expense for contracting for services.
FACILITY AGE	Age of facility, in years

INDICATORS OF SHORT-RUN DISEQUILIBRIUM

Occupancy Segments (used for piece-wise estimation)

OCC1	Occupancy segment defined over 0-80 percent occupancy interval, (i) equal to actual occupancy if less than or equal to 180, and (ii) equal to 80 if occupancy is higher than 80 percent.
OCC2	Occupancy segment defined over 80-90 percent occupancy level, (i) equal to zero if occupancy is less than 80, (ii) equal to actual occupancy ranges between 80 and 90 percent, and (iii) equal to 10 if occupancy is equal to or higher than 90 percent
OCC3	Occupancy segment defined over the 90-95 percent occupancy interval, (i) equal to zero if occupancy is less than 90, (ii) equal to actual occupancy minus 90 if occupancy range, between 90 and 95 percent, and (iii) equal to 5 if occupancy exceeds 95 percent
OCC4	Occupancy segment defined over the 95-100 percent occupancy interval, (i) equal to zero if occupancy is less than 95 percent, (ii) equal to actual occupancy minus 95 if occupancy is greater than 95 percent.

Table 3-A.3 VARIABLE DEFINITIONS, MASSACHUSETTS ANALYSIS

AOC	Average Operating Cost Per Patient Day
Scale	
Capacity	
BEDS	Licensed bed capacity, average for year; see footnote 1
Utilization	
OCC	Total patient days divided by total available bed days (= BEDS x 365) times 100; see footnote 2

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[1]To operationalize the grafting procedure, bed join segments were defined as follows:

BED0	= BEDS if BEDS $\leq$ 40
	= 40 if BEDS > 40
BED40	= 0 if BEDS $\leq$ 40
	= BEDS - 40 if 40 < BEDS $\leq$ 80
	= 40 if BEDS > 80
BED80	= 0 if BEDS $\leq$ 80
	= BEDS - 80 if BEDS > 80

[2]To operationalize the grafting procedure, occupancy join segments were defined as follows:

OCC0	= OCC, if OCC $\leq$ 90
	= 90, if OCC > 90
OCC90	= 0, if OCC $\leq$ 90
	= OCC - 90, if 90 < OCC $\leq$ 93
	= 3, if 93 < OCC
OCC93	= 0, if OCC $\leq$ 93
	= OCC - 93, if 93 < OCC $\leq$ 95
	= 2, if OCC > 95
OCC95	= 0, if OCC $\leq$ 95
	= OCC - 95, if 95 < OCC $\leq$ 97
	= 2, if OCC > 97
OCC97	= 0, if OCC $\leq$ 97
	= OCC - 97, if OCC > 97
OCGE90	= 1, if OCC $\geq$ 90
	= 0 otherwise
OCGE93	= 1, if OCC $\geq$ 93
	= 0 otherwise
OCGE95	= 1, if OCC $\geq$ 95
	= 0 otherwise

VARIABLE DEFINITIONS: MASSACHUSETTS (Cont')

Patient Proportion

Age

PLE49	Proportion of patients on census date who were less than or equal to 49 years old
P5064	Proportion between 50 and 67 years old
PLE59	Proportion 59 or less
P6569	Proportion between 65 and 69
P8089	Proportion between 80 and 89
POLD	Proportion 90 years old or more

Sex

PFEM	Proportion of patients on census date who were female

Admissions Source

PADNH	Proportion of admissions in past year from nursing home
PADHO	Proportion of admissions in last year from private home

Patient Condition

PDISBDR	Proportion of patients on census date confined to bed; bed ridden
PDISNAMB	Proportion of patients on census date confined to non-ambulatory
PDISDEA	Proportion of patients on census date confined to deaf
PDISBLI	Proportion of patients on census date confined to blind
PDISDIS	Proportion of patients on census date confined to disturbed
PDISPSY	Proportion of patients on census date confined to admitted from psychiatric hospital
PDISMR	Proportion of patients on census date confined to mentally retarded
PDISEPI	Proportion of patients on census date confined to epilepsy
PDISEPIC	Proportion of patients on census date confined to controlled epilepsy
PDISEPIV	Proportion of patients on census date confined to uncontrolled epilepsy
PDISCP	Proportion of patients on census date confined to cerebral palsy
PDISCA	Proportion of patients on census date confined to cancer
PDISDIA	Proportion of patients on census date confined to diabetes
PDISDIAD	Proportion of patients on census date confined to diabetes, controlled by diet
PDISDIAM	Proportion of patients on census date confined to diabetes, controlled by medication

Services

PT	Physical therapy available; 1=yes; 2=no
OT	Occupational therapy available; 1=yes; 2=no
SPHT	Speech and hearing therapy available; 1=yes; 2=no
SSAV	Social service available; 1=yes; 2=no
PNURC	Proportion of patients receiving nursing services
PONEB	Proportion of beds - in one-bed rooms
PTHREEB	Proportion of beds - in three-bed rooms
PFOURB	Proportion of beds - in four- or more bed rooms

VARIABLE DEFINITIONS, MASSACHUSETTS ANALYSIS (continued)

Case Flow

ADMISPD	Admission divided by total patient days

Location

Health Planning Region

REG1	1 if Connecticut Valley; 0 otherwise
REG2	1 if Central Massachusetts; 0 otherwise
REG3	1 if North West Suburban Boston; 0 otherwise
REG4	1 if North Shore; 0 otherwise
REG5	1 if West South Surburban Boston; 0 otherwise
REG6	1 if South Eastern Massachusetts; 0 otherwise
REG7	1 if Merrimack Valley; 0 otherwise

Health Systems Area

HSA1	HSA1
HSA2	HSA2
HSA3	HSA3
HSA5	HSA5
HSA6	HSA6
WAGE	County wage rate from (Area Resource file)

Regulatory Variables

PCPRIV	Proportion census on census date that was private pay
PCMCARE	Proportion census on census date that was Medicare

Licensure and Certification

CERCARE	= 1 if certified to provide Medicare services; 0 otherwise
PBCARE	Proportion beds certified for Medicare
PBSNF	Proportion beds licensed a Skilled Nursing Facility beds
PBDF	Proportion beds licensed or SNF beds, but not certified as Medicare beds (= PBSNF - PBCARE)
PBRES	Proportion of beds providing rest home care

Facility Characteristics

NONPROF	= 1 if operated by a nonprofit organization; 0 otherwise
CHAIN	= 1 if operated as part of a group of facilities; 0 otherwise
NCHAIN	Number of facilities operated jointly under one ownership
NCHSQ	NCHAIN squared
MIXED	= 1 if licensed to provide two or more levels of care (SNF - ICF; SNF - RES; ICF - RES; SNF - ICF - RES); 0 otherwise

Table 3-A.4 VARIABLE DEFINITIONS: INDIANA ANALYSIS

AOC	weighted average across SNF, mixed, and ICF homes of operating costs per patient day;*
ADC	weighted average across SNF, mixed, and ICF homes of the mean daily census*
OCC	weighted average of the percentage of beds occupied*
PCTSNF	percentage of county beds which are certified as SNF beds
PCTMIX	percentage of county beds which are certified as both SNF and ICF
SMSA	1 = part of a standard metropolitan statistical area 0 = otherwise
PCTPT	weighted average of the percentage of operating expenses which paid for physical therapy *
PCTCOUN	weighted average of the percentage of operating expenses which paid for counseling and other social services *
AVNURWG	average facility nursing wage in the county (includes RNs, LPNs, and aides)
PCTCAID	weighted average of the percentage of Medicaid patients*
YEAR74	1 = data applicable for 1974 0 = N/A
YEAR75	1 = data applicable for 1975 0 = N/A

*weights defined as the proportion of county beds which are SNF certified, the proportion which are both SNF and ICF certified, and the proportion which are ICF certified.

Table 3-A.5 DETERMINANTS OF AVERAGE OPERATING COSTS: COMPLETE COST MODEL; NATIONAL NCHS DATA

Explanatory Variable	Regression Coefficient	Standard Error	Beta Coefficients
Output: Scale			
CONSTANT	24.2978		
AD1	-0.9678xxx	0.2143	
AD2	-0.0692	0.0442	
AD3	-0.0355xxx	0.0098	
AD4	0.0173	0.0142	-0.0454
AD5	-0.0242	0.0179	
AD6	0.0118	0.0065	
OC1	-0.0132	0.03726	
OC2	-0.1181	0.2054	
OC3	0.0883	0.2206	
OC4	-0.2209	0.2595	-0.0070
OC5	0.0219	0.1508	
OC6	-0.0300	0.1675	
Output: Patient Mix			
AGE	-0.0137	0.0358	-0.0093
FEMALE	-0.0093	0.0124	-0.0178
Diagnosis			
ARTERY	-0.0261xx	0.0113	-0.0344
MENTAL	-0.0166	0.0142	0.0692
STROKE	0.0227	0.0148	0.0388
ACCIDENT	0.0267	0.0210	0.0037
NUTRIT	0.0260	0.0240	0.0125
OLD	0.0017	0.0130	0.0228
RESPIRAT	0.0179	0.0311	0.0049
DIGEST	0.0347	0.0332	0.0081
NEOPLASM	0.0067	0.0313	0.0308
HEART	0.0061	0.0180	
Mental Status			
DEPRES	0.0150xx	0.0076	0.0508
NERVOUS	0.0010	0.0083	0.0057
ABUSE	-0.0129	0.0114	-0.0278
SENILE	0.0045	0.0079	0.0154
SLEEP	-0.0109	0.0088	-0.0318
Activities of Daily Living			
GROOMPD	0.0086	0.0096	0.0250
GROOMD	-0.0131	0.0126	-0.0443
DRESSPD	0.0061	0.0125	0.0220
DRESSD	-0.0050	0.0153	-0.0138
EATPD	0.0195	0.0125	0.0441
EATD	0.0683	0.0509	0.0295
WALKPD	0.0105	0.0115	0.0320
WALKD	0.0104	0.0142	0.0292
BEDPD	-0.0027	0.0091	-0.0076
BEDD	0.0228	0.0214	0.0289
CONTINPD	-0.0404xx	0.0181	-0.0504
CONTIND	-0.0096	0.0115	

Table 3-A.5 DETERMINANTS OF AVERAGE OPERATING COSTS: THE COMPLETE COST MODEL; (Cont'd.) NATIONAL NCHS DATA

Explanatory Variable	Regression Coefficient	Standard Error	Beta Coefficients
Output: Services			
OT	0.8629xx	0.3959	0.0577
RT	0.4081	0.3595	0.0282
REHAB	-0.3649	0.5855	-0.0131
EDUC	0.4643	0.3224	0.0321
PT	0.9129xx	0.4531	0.0583
SPHT	0.0511	0.5040	0.0036
COUNSEL	0.2547	0.3787	0.0166
NASAL	-0.0348	0.0549	-0.0093
BLOOD	0.0077	0.0053	-0.0178
ENEMA	0.0168x	0.0101	-0.0150
CATH	0.0188	0.0250	0.0411
BATH	-0.0040	0.0057	0.0387
BOWEL	-0.0030	0.0085	0.0216
OXYGEN	-0.0470	0.0698	-0.0166
BAND	0.0142	0.0161	-0.0076
PULSE	0.0059	0.0051	0.0163
HYPO	0.0039	0.0073	0.0218
IRRIG	0.0024	0.0198	0.0330
INTRAV	0.0040	0.0004	0.0120
SUMSER	0.0756xxx	0.0267	0.0034
PONEB	0.0133	0.0106	-0.0224
PTHREEB	-0.0017	0.0180	
Output: Case Flow			
ADMISPD	419.3255xxx	43.7281	0.2785
DEATH	0.4914	0.8400	0.0161
Input Prices			
RETAILWG	0.9781xxx	0.3685	0.0580
NURSEWG	2.7800xxx	0.1962	0.3599
SMSA	-0.4922	0.3647	-0.0324
Regulatory Variables			
ICF	-2.1250	0.4822	-0.1299
ICF-SNF	-0.4556	0.3939	-0.0280
PCTPRI	0.0024	0.0069	0.0095
PTCARE	0.0324x	0.0187	0.0466
PM1	-1.4361xxx	0.5313	-0.9084
PM2	-1.2972xx	0.5698	-0.0853
CON	0.0963	0.5983	0.0067
LSC	0.7719x	0.3988	0.0521
LIM	-0.1195	0.6513	-0.0061

Table 3-A.5 DETERMINANTS OF AVERAGE OPERATING COSTS: THE COMPLETE COST MODEL; (Cont'd.) NATIONAL NCHS DATA

Explanatory Variable	Regression Coefficient	Standard Error	Beta Coefficients
Regulatory Variables (continued)			
STAFFA	1.4634xx	0.6987	0.0644
STAFFB	0.3790	1.8280	0.0060
MA	0.3258`	0.6070	0.0214
UNIF	0.7543	0.5315	0.0492
CB	-0.0934x	0.4413	-0.0066
OCCUPEN	0.9779x	0.5464	0.0685
NORTHEAST	3.6221xxx	0.9301	0.2054
CENTRAL	1.7824xx	0.7814	0.1136
SOUTH	2.6091xxx	0.7728	0.1658
Facility Characteristics			
PROFIT	-2.5167xxx	0.6566	-0.1423
NONPROFIT	-0.7752	0.6941	-0.0363
CHANGE	0.6598	1.1558	0.0125
CHAIN	-0.4917	0.3108	-0.0340
PCONTRACT	0.0359	0.0363	0.0216

R^2	0.5847
Adjusted R^2	0.5842
F-ratio	16.0146
N	1127
Standard Error	4.79

x significant at .10 level
xx significant at .05 level
xxx significant at .01 level

Table 3-A.6

DETERMINANTS OF AVERAGE OPERATING COSTS:
COMPLETE OR FULLY-SPECIFIED COST MODELS, NEW YORK
(standard errors in parentheses)

Independent Variable	OLS Regression Coefficients 1974	1975	1976	Beta Coefficients 1975
		OUTPUT CHARACTERISTICS		
Scale				
BEDS1	0.0101 (.0465)	-0.00183 (.0598)	-0.102* (.0614)	-0.00104
BEDS2	0.00388 (.0195)	-0.0238 (.0269)	-0.0324 (.0215)	-0.0465
BEDS3	0.00271 (.0104)	0.00910 (.0101)	0.0118 (.0136)	0.0362
BEDS4	-0.0123 (.0216)	0.0146 (.0148)	0.00649 (.0145)	0.0369
BEDS5	0.00207 (.00645)	0.00364 (.00640)	-0.000977 (.00658)	0.0164
Patient Age Distribution				
%UNDER65	0.0456 (.0737)	-0.0101 (.0807)	0.00293 (.0813)	-0.00641
%AGE75TO84	0.0294 (.0418)	0.0114 (.0529)	0.0242 (.0499)	0.00986
%OVER84	0.0309 (.0375)	-0.0127 (.0448)	0.0292 (.0447)	-0.0164
%FEMALE	0.0412 (.0254)	0.0290 (.0296)	0.0451 (.0321)	0.0327
Patient Functional Status Variables (percentages of patients requiring assistance)				
%Walk	0.0334* (.0164)	-0.0119 (.0166)	0.0272 (.0168)	-0.0301
%Eat		0.0453***(.0134)	-0.00881 (.0134)	0.129
%Bathe		0.0319* (.0193)	0.0207 (.0179)	0.0587
%Breathe		-0.00634 (.00658)	-0.00144 (.00635)	-0.0258
%Dress		0.00550 (.0179)	0.0153 (.0164)	-0.0159
%Correspond		0.0229* (.0127)	0.00194 (.0114)	0.0720
%Medicate		-0.00258 (.0175)		-0.00404
%Massage		-0.00200 (.0102)	0.00788 (.0103)	-0.00636

*Significant at .10 level
**Significant at .05 level
***Significant at .01 level

Table 3-A.6 (cont'd.)

Independent Variable	Regression Coefficients 1974	1975	1976	Beta Coefficients 1975
Patient Impairment Variables (percentages of patients with impairment)				
%ALERT			-.0159 (.0112)	
%SEE			.0204* (.0118)	
%HEAR			-.0100 (.0130)	
%SPEAK			-.00304 (.0153)	
%COMMUNICATE			-.00136 (.0142)	
%DEATHS	-.00625 (.0205)		-.0124 (.0254)	
ADMRATE	342* (191)	1050*** (148)	276 (273)	.332
Service Offerings (0-1)				
DRUGS		-.337 (.599)		-.0156
PHYS THERAPY		.211 (.852)		.00705
OCC THERAPY		.770 (.587)		.0364
SPEECH THERAPY		-.324 (.623)		-.0157
SPECIAL DUTY		-.667 (1.50)		-.0118
PHYS SERVICES		.935 (.654)		.0458
OTHER SERVICES		.520* (.300)		.0650
Service Intensity				
#PRESCRIPTIONS		.00132 (.00284)	.0121* (.00723)	.0114
#X-RAYS		.341*** (.112)	.613***(.101)	.0846
#PHYSICAL THERAPY		3.14*** (.976)	1.25* (.564)	.108
#SPEECH THERAPY		.343 (6.14)	13.1* (7.5)	.00163
#OCC THERAPY		.844 (1.47)	.151 (.336)	.0157
#INHAL THERAPY		14.6** (7.02)	-6.18 (12.6)	.0535
#RADIATION THERAPY		-.933 (3.83)	33.0 (30.0)	-.00582
#SOC SERVICE		1.02** (.429)	.437 (.407)	.104

*Significant at .10 level
**Significant at .05 level
***Significant at .01 level

Table 3-A.6 (cont'd.)

Independent Variable	Regression Coefficients 1974	1975	1976	Beta Coefficients 1975	
Bedroom Distribution					
%1BED		.0316*** (.0158)	-.0131 (.0365)	.0715	
%3BED		-.0165 (.0118)	-.0312 (.0229)	-.0428	
		INPUT PRICE VARIABLES			
LPN WAGE		.701***(.187)		.106	.285
RETAIL WAGE	6.51* (2.12)	6.29***(2.31)	6.83* (2.30)	.179	
POPDEN	-.0000506 (.00003)	.00000865 (.00004)	.0000123 (.0004)	.0139	
Bed-Size Categories					
SIZE2					
SIZE3		1.12 (.782)		.0512	
SIZE4			-2.23* (1.10)		
SIZE5	4.89* (2.32)				
Regions					
REGION2	-.784 (1.19)	-1.36 (1.27)	-.759 (1.26)	-.0389	
REGION3	-.402 (1.02)	-.841 (1.11)	-.993 (1.20)	-.0281	
REGION4	-.629 (1.14)	-.696 (1.26)	-.888 (1.14)	-.0221	
REGION5	4.14* (1.50)	2.88* (1.58)	4.21*[a] (1.21)	.0965	
REGION6	4.92* (1.55)	5.07***(1.73)		.151	
REGION7	6.42* (1.53)	4.02**(1.76)	4.68* (1.58	.182	

*Significant at .10 level
**Significant at .05 level
***Significant at .01 level
[a]Regions were combined for grouping purposes in 1976.

Table 3-A.6 (cont'd.)

Independent Variable	Regression Coefficients 1974	1975	1976	Beta Coefficients 1975
TECHNOLOGY OR PRODUCTION PROCESS VARIABLES				
SNF-HRF		-1.79**(.706)	-.973 (.722)	-.0745
HRF-SNF		-1.72 (1.14)	-.619 (1.14)	-.0691
CLINIC		-2.79 (1.97)		-.0342
%CONTRACT		-.0651 (.0514)		.0625
FACILITY AGE		-.0182 (.0130)		
INDICATORS OF SHORT-RUN DISEQUILIBRIUM				
Occupancy Segments				
OCC1	.119 (.140)	.0442 (.0428	-.0566 (.269)	.0484
OCC2	-.204**(.183)	-.223 (.179)	-.273 (.249)	-.0745
OCC3	.0845 (.288)	.267 (.300)	-.147 (.324)	.0507
OCC4	.184 (.185)	-.00893 (.102)	-.216 (.144)	.00265
CONSTANT	17.0	4.23	25.0	
Summary Statistics				
Coefficient of Determination (R^2)	.647	.768	.764	
Corrected Coefficient of Determination	.622	.736	.743	
F-Ratio	25.6	24.0	25.9	

*Significant at .10 level
**Significant at .05 level
***Significant at .01 level

Table 3-A.7

DETERMINANTS OF AVERAGE OPERATING COSTS:
COMPLETE COST MODELS FOR MASSACHUSETTS
(Standard errors in parenthesis)

Explanatory Variable	Regression Coefficients 1973	1974	1975
Constant	34.4131	34.9089	20.8976
Capacity			
BED0	0.0218(.0318)	-0.0243(.0261)	-0.0223(.0303)
BED40	-0.0271*(.0160)	-0.0200(.0139)	-0.0157(.0153)
BED80	0.0069(.0080)	0.0001(.0052)	-0.0029(.0056)
Utilization			
OCC0	-0.2376***(.0369)	-0.2122***(.0598)	-0.1196*(.0648)
OCC90	-0.7890(.6901)	1.2383***(.4469)	0.2005(.3112)
OCC93	0.1872(.7104)	-0.3405(.5943)	-0.4396(.5225)
OCC95	-1.198***(.4413)	-0.5992*(.3126)	0.8581***(.3306)
OCC97	0.4638*(.2722)	0.0952(.2183)	0.2991(.2370)
OCGE93	2.9296*(1.7056)	-1.715(1.0835)	--
OCGE93	--	-1.6967*(1.0021)	--
OCGE95	1.3433(1.0819)	1.2268(.7798)	1.6132*(.8240)
Patient Mix			
PLE49	--	-1.216(3.521)	1.633(4.003)
PSO64	--	4.283*(2.197)	-0.702(2.276)
PLE59	-7.094(2.6296)	--	--
P6569	--	2.766(2.500)	0.804(2.870)
P8089	0.0821(1.4887)	-1.529(1.591)	-0.788(1.621)
POL	7.0736***(2.3696)	3.259*(1.857)	1.625(2.297)
Sex			
PFEM	-9.686(1.0001)	0.605(.769)	1.222(.956)

*Significant at .10 level
**Significant at .05 level
***Significant at .01 level

Table 3-A.7 (Cont'd.)

DETERMINANTS OF AVERAGE OPERATING COSTS:
COMPLETE COST MODELS FOR MASSACHUSETTS
(Standard errors in parenthesis)

Explanatory Variable	Regression Coefficients 1973	1974	1975
Admission Source			
PADNH	-0.5818(1.3369)	--	-1.994(1.312)
PADHO	2.0395(1.1646)	--	1.222(1.222)
Conditions			
BEDRIDDEN	0.0981(2.3302)	--	--
WALK	--	1.733**(.756)	2.127**(.885)
DEAF	0.3710(3.8219)	-3.658(3.811)	5.599*(3.103)
BLIND	5.8025(6.0472)	-1.166(4.424)	--
DISTURBED	0.0562(.8095)	--	--
PSYCH	--	-1.185(.937)	-0.213(1.102)
RETARD	-2.4350(2.4128)	-2.432(1.716)	1.684(2.669)
EPILEPSY1	-0.6027(5.8503)	--	--
EPILEPSY2	--	-3.122(4.670)	-0.4090(4.623)
EPILEPSY3	--	-4.276(13.990)	2.118(19.273)
PALSY	2.1153(16.4487)	12.200(10.014)	8.413(9.839)
CANCER	--	7.880**(3.130)	4.807(5.833)
DIABETES1	--	2.798(1.969)	--
DIABETES2	--	--	-0.507(2.399)
DIABETES3	--	--	0.947(2.479)
Services			
PT	-0.9597(.7555)	0.861**(.346)	0.850*(.400)
OT	-0.2767(.4797)	--	--
SPHT	0.2518(.4983)	--	--
COUNSEL	0.8684(.4833)	--	--
PNURC	--	0.190(.614)	1.070*(.568)

*Significant at .10 level
**Significant at .05 level
***Significant at .01 level

Table 3-A.7 (Cont'd.)

DETERMINANTS OF AVERAGE OPERATING COSTS:
COMPLETE COST MODELS FOR MASSACHUSETTS
(Standard errors in parenthesis)

Explanatory Variable	Regression Coefficients 1973	1974	1975
PONEB	--	1.875(1.378)	4.494***(1.448)
PTHREEB	--	-0.333(.548)	-1.028(.627)
PFOURB	--	-1.125*(.613)	-0.98(.711)
Case Flow			
ADMISPD	377.507***(105.553)	262.374***(94.040)	113.801(123.67)
Location			
REG1	-3.4382***(.6605)	-2.674***(.490)	--
REG2	-2.3740***(.6377)	-2.240***(.492)	--
REG3	-1.3853*(.7764)	-0.497(.555)	--
REG4	-0.6099(.6689)	0.400(.472)	--
REG5	-1.8192(.6559)	-0.800*(.484)	--
REG6	-2.6450***(.6190)	-1.161**(.466)	--
REG7	-1.1010(.6988)	-.912*(.541)	--
HSA1	--	--	-1.366**(.645)
HSA2	--	--	-1.937***(.559)
HSA3	--	--	-0.307(.707)
HSA5	--	--	-0.450(.541)
HSA6	--	--	0.803(.538)
Area Descriptors			
WAGE	--	--	3.906(4.819)
Regulation Payment Proportion			
PCPRIV	2.5785***(.8510)	4.548***(.836)	5.154***(.879)

*Significant at .10 level
**Significant at .05 level
***Significant at .01 level

Table 3-A.7 (Cont'd.)

DETERMINANTS OF AVERAGE OPERATING COSTS:
COMPLETE COST MODELS FOR MASSACHUSETTS
(Standard errors in parenthesis)

Explanatory Variable	Regression Coefficients 1973	1974	1975
Licenses and Certificates			
CERCARE	0.6669(.6532)	--	--
PBCARE	--	3.968***(.870)	3.193***(1.038)
PBSNF	4.2438***(.6986)	--	--
PBDF	--	4.527***(.639)	5.769***(.626)
PBRES	-5.8993**(2.5874)	-5.628***(1.459)	-6.144***(1.764)
Facility Characteristics			
NONPROF	3.5752***(.7841)	3.669***(.665)	2.726***(.581)
CHAIN	--	-.293(.475)	--
NCHAIN	--	--	0.176**(.088)
NCHSQ	--	--	-.00661*(.003)
MIXED	.8036(.4990)	1.089***(.394)	1.331***(.451)
R^2	0.656	0.713	0.719
df	410	419	388
F	18.590	21.644	20.260
S.E.	3.401	2.575	2.821

*Significant at .10 level
**Significant at .05 level
***Significant at .01 level

Table 3-A.8

DETERMINANTS OF AVERAGE OPERATING COSTS: THE COMPLETE COST MODEL; INDIANA 1973, 1974, 1975 RESULTS

Explanatory Variable	OLS Regression Coefficients 1973	1974	1975	Beta Coefficients 1975
R^2	.7219	.4711	.5448	
Adjusted R^2	.6308	.3189	.4053	
F-ratio	7.9253***	3.0948***	3.9064***	
N	78	86	82	
Standard Error	1.4754	1.7936	1.63037	
Output: Scale				
Constant	4.3975	10.4957	12.2113	
AD1	0.0583(.0408)	0.0428(.0560)	0.0077(.0528)	0.020
AD2	-0.0302**(.0140)	0.0009(.0173)	0.0027(.0176)	0.025
AD3	0.0443**(.0192)	-0.0099(.0258)	-0.0145(.0171)	-0.156
AD4	-0.0714**(.0308)	0.0184(.0284)	0.0136(.0207)	0.136
AD5	0.0271(.0269)	-0.0008(.0212)	0.0070(.0229)	0.056
AD6	0.0005(.0013)	0.0008(.0011)	-0.0003(.0013)	-0.031
OC1	0.0028(.0231)	0.0147(.0305)	-0.0116(.0309)	-0.086
OC2	-0.0085(.2598)	-0.0520(.3845)	0.4333(.4146)	0.515
OC3	0.1999(.2970)	-0.0447(.5417)	-0.4557(.5515)	-0.527
OC4	-0.0326(.3531)	-0.4112(.5438)	-0.0574(.4913)	-0.040
OC5	-0.1040(.1933)	0.3792(.3066)	-0.0272(.2616)	-0.023
OC6	0.0027(.0034)	-0.1243(.5204)	-0.2308(.4680)	-0.064
Output: Services				
PCTPT	-0.1124(.1997)	0.2140(.1816)	0.1288(.1420)	0.085
PCTCOUN	-0.5607(.4509)	-0.2044(.3447)	-0.2223(.3119)	-0.0683
Regulatory Variables				
PCTSNF	0.711(.0567)	-0.250(.0316)	-0.216(.0285)	-0.079
PCTMIX	0.375***(.0071)	0.0313***(.0072)	0.0278***(.00800)	0.476
PCTCAID	0.0072(.0127)	-.0172(.0166)	0.0021(.0179)	0.012

Table 3-A.8: DETERMINANTS OF AVERAGE OPERATING COSTS FOR INDIANA COUNTIES (continued)

Explanatory Variable	Regression Coefficients 1973	1974	1975	Beta Coefficients 1975
Input Prices				
NURSWG	3.5925***(.9411)	.4487(.8161)	.8608(.6616)	0.134
SMSA	.0047(.4689)	-.5543(.5071)	-.1594(.4813)	-0.032

*Significant at .10 level
**Significant at .05 level
***Significant at .01 level

Table 3-A.9

RESIDUAL F TEST RESULTS:

Whether or not Omitted Variables were Statistically Significant[1]

	National	Massachusetts 1975	New York 1975
Occupancy	no(0.23;2.10)	no(1.79;2.12)	no(0.54;2.23)
ADC	yes(11.41;2.10)	--	--
ADC & Occupancy	yes(6.70;1.76)	--	--
Beds	--	no(1.24;2.64)	no(0.94;1.85)
Occupancy & Beds	--	no(1.73;1.90)	no(0.74;2.23)
Patient Characteristics			
ADL	no(1.29;1.76)	--	yes(4.44;1.96)
Diagnosis	yes(1.82;1.76)	no(1.14;1.85)	--
Age & Sex	no(0.48;3.00)	no(1.80;3.02)	no(0.05;2.30)
ADL, Diag., Age & Sex	yes(1.58;1.47)	no(1.26;1.83)	--
Services (all measures)	yes(2.21;1.58)	yes(3.85;3.02)	yes(4.27;1.60)
Services Offered	yes(2.77;2.02)	--	no(1.35;2.03)
Services Provided	no(1.49;1.76)	--	yes(5.39;1.96)
Regulatory Variables	yes(8.50;1.80)	--	--
Payment Proportion	no(0.05;3.00)	yes(22.17;3.02)	--
Facility Variables	no*(0.72;2.61)	yes**(7.91;3.83)	--

*Does not include nonprofit

**Includes nonprofit

[1] F test calculations were based on the complete regression results presented above in Tables A.6-2 to A.6-5 as compared with regression results excluding the omitted variables. The first number in the parentheses is the calculated F statistic; the second number is the .05 significance level F statistic for the appropriate degrees of freedom. For an omitted set of variables to be significant at the .05 level, the calculated F statistic must exceed the second number in parentheses.

Table 3-A.10
SUM OF BETA WEIGHTS FROM COST EQUATION ESTIMATES

	National	Massachusetts 1975	New York 1975
Services Offered	0.1668	0.0707	0.1111
Services Provided	0.1182	0.0571*	0.3730
Capital Sources	-0.019	0.0372	0.0287
Case Flow			
ADMISPD	0.2785	0.554	0.3320
Input Prices	0.4179	0.0508	0.2850
Urban-Rural			
SMSA	-0.0324	0.0304	0.0139
POPDEN	--	--	--
Patient Mix			
Age	-0.0093	0.01528	0.0427
Diagnosis	0.1564	0.02643	--
Marital Status	0.0123	0.0151	--
ADL	0.0946	0.0822	0.1775
Impairments	--	-0.0517	--
Admission Source	--	-0.0090	--

CHAPTER 4

A MULTI-EQUATION MODEL OF NURSING HOME COST BEHAVIOR--A SUMMARY*

4.0 Introduction

In this chapter the 1972-1973 NCHS national data are used to explore a more complex model of nursing home behavior and examine whether or not it has any different implications for the design and evaluation of nursing home reimbursement alternatives. If cost was the only criterion of interest, it might be sufficient to estimate single-equation models of nursing home cost behavior--as done in Chapter 3. However, cost per se is not the only aspect of nursing home behavior about which the public is concerned. For example, the nursing home output may be regarded as being multi-dimensional in nature and composed of (1) the number of patient-days of care and (2) the "quality" or service intensity associated with each day. Whereas the cost functions already presented describe the effect of reimbursement and regulation on the operating cost per patient-day, any impact on service intensity cannot be seen from these relationships. Thus, the reimbursement scheme that might emerge from a cost modeling effort alone could entail unknown and unacceptable reductions in service intensity. Moreover, it could also entail unintended and undesired consequences along other dimensions of interest (e.g., occupancy and access).

Furthermore, failure to take account of these effects in single-equation cost estimation can lead to serious misinterpretation of the results. For example, if service intensity were included in the cost equation--as it has been in the single-equation estimation--and service intensity were found to be related to reimbursement, then the coefficients elicited for reimbursement variables in the cost equation would not give their total effect on cost. They would give only their direct effects. The indirect effects--i.e., the cost effects of reimbursement-induced service intensity differentials--would be reflected in the service intensity coefficients and thus would not be apparent from single-equation estimation.

This chapter investigates such prospects--that is, it investigates whether or not nursing home operators react to reimbursement regulation along

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relevant behavioral dimensions other than cost. In particular, it models empirically the effects of reimbursement and regulation on the following variables of interest:

(1) nursing hours per patient-day;

(2) an index of rehabilitative-type services;

(3) the occupancy rate;

(4) the mix of public-private patients; and

(5) the rate charged to private patients.

However, these variables are themselves inter-related and it is not possible to estimate reduced-form relationships for them without first specifying the underlying structural (or simultaneous) model.[1] Furthermore, such a structural model must itself be estimated and favorably evaluated if the reduced-form relationships that derive from it are to have validity.

Because a complete discussion of the methodology is quite complex, this chapter summarizes the approach and concentrates on the results. Technical Paper #8 contains a complete discussion of the simultaneous equation modeling. In brief, the results of the multi-equation model underline the importance of simultaneity issues in analyzing nursing home behavior. For example, it was found that an increase in service intensity increases operating costs, but it also increases occupancy rates and the percentage of private patients in a home--both of which lower costs, ceteris paribus. Furthermore, regulation and rate setting have a range of effects on variables other than cost. In particular, reimbursement variables also affect nursing and service intensity, the rates charged to private patients, and the public-private mix. For example, prospective reimbursement leads to an increase in the number of nursing hours per patient day and services provided to patients. It appears that retrospective and flat rate reimbursement systems, which lead to a reduction in costs, also lead to a reduction in service intensity and access to public patients. Further, prospective reimbursement leads to an increase in the private rate and a decrease in the

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[1] The structural form of a model is the set of behavioral relations--i.e., the ones derived from economic theory. The reduced form of a model is derived from the structural form and is the set of relations expressing the "equilibrium" impact of each exogenous variable on each of the variables being modeled, taking account of "feedback" or "multiplier" effects.

relative private-to-public mix of patients. Several other results should be noted. The demand for nursing home care by private-pay patients is not price inelastic; and further, private-pay patients are paying higher rates than public patients to begin, and cost controlling reimbursement features increase the differential. Further, private patients appear to subsidize public patients. There is no evidence that occupancy penalties affect the occupancy rate. Finally, there appears to be only a weak relationship between patient condition variables and service intensity and cost of care.[1] In sum, rate setting cannot proceed by simply analyzing the costs of nursing homes. Rather, a more comprehensive understanding of the nursing home environment is necessary if unintended and undesirable consequences are to be avoided.

The remainder of this chapter is organized as follows. The structural model is developed in the next section, Section 4.1. A summary of the results of estimating the structure model are reported in Section 4.2. Results of the reduced form model are in Section 4.3. Section 4.4 discusses the implications for designing of a reimbursement scheme. Readers interested in a more technical discussion are referred to Technical Paper #8.

4.1 The Model

The multi-equation simultaneous system of equations developed herein describes nursing home market behavior in the short to intermediate run over which bed-size is fixed. The model is unusual inasmuch as it attempts to model supply and demand behavior with respect to individual nursing homes rather than within defined catchment or market areas. While a catchment area model would have been more conventional, the requisite data were not available.[2] Furthermore, this study is explicitly interested in the predictability of individual nursing home behavior inasmuch as individual homes are the units for rate setting.[3]

The structural model encapsulates the key behavioral relationships identified from theoretic discussion in the literature review (Technical

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[1] This last result is subject to qualification because of an error-in-variables problem and the absence of measures of quality.

[2] Inasmuch as the NCHS data includes only a sample of nursing homes, it is not possible to aggregate information from all facilities in each catchment area. The sample is representative of the nation, but not of smaller geographic areas.

[3] We are not aware that our facility-level specification suffers any serious econometric problems; the specification is merely unconventional for a multi-equation market model.

Paper #2). The model focuses on the behavioral parameters noted above. Whereas the underlying hypothesis that regulation impacts these variables does not emerge herein from a formal model of nursing home behavior, nursing home operators and rate setters themselves suggest the importance of such effects. Furthermore ad hoc-type theoretic arguments lend support that regulatory variables impact on the behavior of nursing homes; it is the fundamental assumption underlying regulation that the regulations will induce changes in behavior.

Consider now each of the behavioral variables to be examined. The nursing hours per patient-day and index of rehabilitative service variables each measure a distinct service-quality dimension of nursing home care. It is hypothesized that cost-based reimbursement offers indirect incentive to increase the service intensity inasmuch as a greater "profit" accrues to more costly days. Services are negatively-related to reimbursement control, since if costs are not met, the nursing home operator will have to curtail services provided or incur a loss. In addition, improvement of the quality or service intensity of care may itself be an objective of some nursing home operators, especially in nonprofit facilities.

The occupancy rate is a straightforward measure of the quantity of nursing home care--i.e., quantity relative to capacity--provided by each nursing home. It is hypothesized that the quantity of patient care supplied by existing nursing homes varies directly with the overall generosity of public reimbursement--which is to say little more than that the supply curve is upward sloping.

The public-private patient mix, as reflected by the percentage of private patients variable, is an inverse measure for the relative access of public patients to nursing home care; the hypothesis is that the percentage of private patients increases with the ratio of private and public prices--or that, ceteris paribus, the lower the public rate of reimbursement, the larger is the private sector component since operators have relatively less of an inducement to take public patients. (Since the data indicate that a larger private sector component corresponds to a longer waiting list for admission, the public-private mix variable corresponds with reduced access for public patients.)

Finally, the per-diem rate charged by nursing homes to private patients may or may not be related to public reimbursement policies. The private and public markets for nursing home care are obviously not independent of one another, but the nature of interdependency has not been investigated empirically. For example, it is possible that the private rate subsidizes public patients or that a higher public rate also implies a higher rate for private patients. We shall test for such effects.

The structural model can be represented as follows:

The Average Operating Cost Function

$$(1)\quad AOC = f\ \left(Q,\ S_1,\ S_2,\ \frac{Q_p}{Q_p + Q_G},\ \frac{Q}{365 * BEDS},\ P_p,\ F,\ Y,\ P_{input},\ R,\ M\right)$$

The Two Service Intensity Equations

$$(2)\quad S_1 = f_2\ \left(Q,\ S_2,\ \frac{Q_p}{Q_p + Q_G},\ F,\ Y,\ P_{input},\ R,\ M\right)$$

$$(3)\quad S_2 = f_3\ \left(Q,\ S_1,\ \frac{Q_p}{Q_p + Q_G},\ F,\ Y,\ P_{input},\ R,\ M\right)$$

The Demand Equation (In Occupancy Form)

$$(4)\quad \frac{Q^D}{365 * BEDS} = f_4\ \left(S_1,\ S_2,\ P_p^D,\ \frac{Q_p}{Q_G + Q_p},\ F,\ R,\ M\right)$$

The Inverse Supply Function

$$(5)\quad P_p^S = f_5\ \left(Q,\ S_1,\ S_2,\ \frac{Q}{365 * BEDS},\ F,\ P_{input},\ R,\ M\right)$$

The Relative Supply Function

$$(6)\quad \frac{Q_p}{Q_G + Q_p} = f_6\ \left(Q,\ S_1,\ S_2,\ P_p,\ F,\ R,\ M\right)$$

Identities

$$(7)\quad p_p = P_p^S = P_p^D$$

$$(8)\quad \frac{Q_G}{Q_p + Q_G} = \frac{1-Q_p}{Q_p + Q_G}$$

$$(9)\quad Q^d = Q^S = Q$$

Where AOC is average operating cost per patient-day,

Q	is the number of patient-days provided,
Q_G	is the number of patient-days provided to government patients,
Q_p	is the number of patient-days provided to private patients,
$\frac{Q_p}{(Q_p + Q_G)}$	is the fraction of total patient-days provided to private patients--equal to one minus the fraction of patient days provided to government patients,
S_1 and S_2	are indicators of service intensity or "quality",
BEDS	is the number of beds in the nursing home,
$\frac{Q}{365 * BEDS}$	is the average occupancy rate,
P_p	is the price per patient-day charged to private patients,
F	is a vector of facility characteristics (e.g., profit/non-profit and ICF/SNF),
Y	is a vector of patient characteristics,
P_{input}	is a vector of input prices (e.g, wage levels),
R	is a vector of characteristics describing reimbursement and other regulatory criteria (e.g., life-safety code requirements),
M	is a vector of market characteristics (e.g., urban/rural, income level and nursing bed/population ratio),
	and where superscript "d" denotes demand,
	and superscript "s" denotes supply.

Consider now the specifications for each of the equations and the rationales for hypothesizing inter-relationship of dependent variables. The conceptual representation and underlying hypothesis of the Average Operating Cost Equation are similar to those indicated in Chapter 3's single-equation cost estimation.

Two Service Intensity Equations were indicated with services identified as S_1 and S_2. Operationally, these two service dimensions are defined as (1) nursing hours per patient-day and (2) an index of rehabilitative-type services. In each of the two service intensity equations, the one service variable is indicated as a function of the other--i.e., S_1 is a function of S_2 in equation (2) and S_2 is a function of S_1 in equation (3). The reasoning is as follows. Ceteris paribus, a nursing home cannot provide more of one service without providing less of the other. Hence the hypothesis is that each right-hand-side service variable coefficient will be negative in the other service equation. The percentage private patients variable $(\frac{Q_p}{Q_p + Q_G})$ is included in both service relationships to control for potential differences in public/private preference. The general presumption has been that private patients demand greater service intensity.

The occupancy equation is represented as a Demand Equation. It is to reflect the level of catchment area demand for nursing home care within a particular facility. The service intensity variables (S_1 and S_2) are included because they are, along with Q, dimensions of output. The average private rate (P_p) is the demand price variable for private patients. (Public demand is assumed to be price inelastic--i.e., insensitive to price--since almost no cost is incurred by most public-pay patients.) Finally, the percentage-private variable $(\frac{Q_p}{Q_p + Q_G})$ is included to control, in the best available manner, for regional variation in the relative intensity of public and private demand. The general presumption is that private patients are willing to pay a premium for access and not have to wait for admission. Since the likelihood of having to wait varies directly with the occupancy level, an inverse relationship between occupancy and the percentage-private (endogenous) variable is hypothesized.

The private rate equation is meant to be an Inverse Supply Function. That is to say, it expresses the supply price as a function of the quantity supplied. As usual, it is hypothesized that the supply price varies directly with the quantity supplied--i.e., that it varies directly with occupancy. Similarly, it is hypothesized that a greater service intensity implies a higher price.

The Relative Supply Function has the percentage of private patients as its dependent variable to reflect the relative access of public and private patients to nursing home care. All other things equal, as the fraction of patient days provided to private patients increases, approaching one in the limit, increasing numbers of potential public patients are likely to end up on a waiting list. The service intensity variables (S_1 and S_2) are included to control for differential public and private preferences. It is anticipated that private patients demand a greater service intensity. Ceteris paribus, it is hypothesized that a greater private price is required to induce a nursing home to supply the private sector. That is, the nursing home is seen as being a "price maker" with respect to private patients.

Turning now to the empirical specifications, the variables included in each relationship in the multi-equation system are indicated in Table 4-A.1. The variables are defined in Table 4-A.2; empirical results are in Tables 4-A.3 and 4-A.4. These tables are contained in Appendix 4-A. Standard deviations for these variables and estimated coefficients are presented in Technical Paper #8.

The structural model is estimated and discussed in the next section, Section 4.2. This is done primarily to validate the overall model--i.e., to demonstrate that the structural specification is an analytically meaningful one. However, it is more relevant for policy purposes to estimate and examine the reduced-form equations in Section 4.3. All endogenous variables are omitted in estimating reduced-form relations, and the reduced-form coefficients give the equilibrium impact of a change in any exogenous variable, including the rate setting rules, on any endogenous variable.

4.2 The Structural Equations

The multi-equation structural model specified above has been estimated in Table 4-3. The average operating cost (AOC) relationship was estimated by ordinary-least-squares. The other five relationships form a

simultaneous-equations system, as discussed above, and were estimated by two-stage-least-squares techniques. The dependent or endogenous variables in these relationships are as follows:

(1) average per diem operating cost (AOC),

(2) nursing hours per patient-day (NHRPD),

(3) an index of rehabilitative-type services (INDEX),

(4) average percentage occupancy (OCCEN),

(5) the percentage of total patient-days provided to private-pay patients (PCTPRIV), and

(6) the average price charged to private patients (PRIVRATE).

A summary of the structural results is useful prior to discussing the specific results of each equation.

In brief, the following is shown:

(1) The results affirm the importance of simultaneity issues in analyzing nursing home behavior. It is a more complex behavioral environment than can be portrayed by a single-equation causal nexus. For example, it is found that an increase in service intensity increases operating costs, but also that it increases occupancy and percentage private patient mix, both of which lower costs, ceteris paribus. In addition, a greater service intensity implies a higher private rate, which in turn implies a lower occupancy level and thereby higher operating costs. On the other hand, a lower occupancy level implies again a higher private rate.

(2) The reimbursement and regulatory variables do indeed impact variables of interest other than cost. In particular, we have shown in the structural analysis that reimbursement variables also affect nursing and other service intensity, the rates charged to private patients and the private-public patient mix--a proxy for access. In addition, occupancy levels are impacted indirectly.

The results of the individual equations are discussed below.

4.2.1 The Average Operating Cost Equation

The Average Operating Cost Equation relationship is similar to the cost functions estimated in single-equation cost modeling from the same NCHS data used in Technical Paper #4. However, the specifications and purposes of this AOC cost model are fundamentally different from those in the single-equation estimation. In particular, the nursing intensity variable

(NHRPD) had been excluded from the single-equation model because of a concern that it presented a serious endogeneity problem. As will be seen from the NHPRD relation, that hypothesis receives strong support. Inasmuch as this variable is also seen below to be highly important to the structural AOC relation, it should not be surprising that some findings from this analysis are different from those in single-equation estimation.

The AOC relation includes both endogenous and exogenous variables. The so-called endogenous variables are those that have been hypothesized to also depend upon reimbursement and regulatory criteria, whereas the exogenous variables are essentially assumed to be independent or not determined by operators in the short-run. We begin by discussing the results with respect to the endogenous variables--that is, those variables for which we also model the impact of reimbursement and regulation.

All of the endogenous variables included in this structural cost equation are significant at the .10 level or better. As suggested above, the NHRPD (nursing hours per patient day) variable is highly significant with a t-statistic--the coefficient divided by its standard error--in excess of 18. The quantitative importance of this variable is also large; the beta coefficient is 0.455. To the extent that nursing homes per patient days are a function of the regulatory and reimbursement variables, there is evidence that regulation and reimbursement effects operating costs both directly and indirectly. Evidence about this indirect effect as well as other indirect effects are presented below. Hence, this is the first of many pieces of evidence from the multi-equation model that regulation and reimbursement decisions have multiple direct and indirect effects, such that the design of a reimbursement system must consider both the direct and indirect effects as well as its intended and unintended consequences.

The significant (negative) coefficient on percentage occupancy (OCCEN) contrasts sharply with the insignificant findings for occupancy variables in the single-equation estimation (Technical Paper #4). It is further interesting that, ceteris paribus, a higher percentage of private patients (PCTPRIV) is now found to be associated with a significantly lower cost level. We attribute both of these results to inclusion of the NHRPD variable and its effect on the public-private mix and occupancy equations. In those equations we find that increased hours of nursing also increases the

relative share of beds occupied by private patients as well as the occupancy rate. The INDEX service intensity variable has the anticipated positive (significant) effect on average operating costs--i.e., the more services, the more costly.

4.2.2 The Two Service Intensity Equations

The nursing hours per patient-day (NHRPD) and rehabilitative-type service index (INDEX) variables have been assumed to measure input dimensions of nursing home service quality. Because of the similarity in purpose and specification, we consider both relationships at once. The results clearly substantiate the thesis underlying the entire multi-equation effort. In particular, the results show that reimbursement parameters are indeed statistically significant determinants of service intensity or "quality" in nursing homes. For example, retrospective reimbursement is found to imply a 0.2 reduction in nursing hours per patient-day compared to prospective reimbursement. (The mean value of NHRPD is 2.45.) Similarly, negative impacts on service intensity are found to be associated with flat rate reimbursement. Furthermore, these findings are in accord with those from the cost relation. Whereas retrospective and flat rate reimbursement were there shown to decrease costs, we now find that they also decrease services--and thereupon perhaps quality. That is, cost reductions have been achieved, at least in part, by reducing services--a perhaps unintended outcome from the perspective of the rate setter.

With respect to the reimbursement and regulatory variables, the results for PM1 indicate that retrospective reimbursement is associated with significantly lower levels of service intensity--NHRPD and INDEX both--relative to prospective reimbursement. An even larger negative effect on INDEX is estimated with respect to flat rate reimbursement. These results were alluded to in the discussion of the average operating cost equation: reimbursement affects services, which in turn affect costs. Also, a limit or ceiling on reimbursement (LIM) is found to be associated with a significantly lower nursing intensity--as one would predict for any measure that limits reimbursement and thereupon the resources available to pay for service

intensity. A uniform chart of accounts (UNIF) is associated with a significantly higher INDEX value; however, this may merely reflect the greater definitional precision associated with such more formal accounting. That is, an otherwise similar facility not subject to uniform accounting and definitions might not report that it provides so many services because services are not organized and accounted in the same fashion.

4.2.3 The Demand Equation (In Occupancy Form)

The percentage occupancy (OCCEN) relation was meant to reflect the market area demand for care within a particular nursing home facility. The two most important variables in the model--in terms of their beta coefficients--are the ADMISPD admissions per patient-day and NHRPD nursing intensity variables. The latter service variable is also endogenous and has been seen to be significantly related to the other reimbursement variables. Thus, indirectly, occupancy is also a function of other reimbursement parameters--as is also shown in the reduced-form relation. That is, reimbursement affects the nursing intensity, and the nursing intensity affects occupancy. Another finding of general interest is the result that states with certificate-of-need programs have significantly higher occupancy levels. That is, we find indirect evidence that the CON program is having the desired effect of increasing facility utilization. The result indicates that a CON program increases the occupancy rate by 2.5 percentage points.

Also of note is the significant, negative coefficient for the private price (PRIVRATE) variable--i.e., private demand is seen to increase as price decreases. Apparently, nursing services are much demanded as shown by the positive and highly significant coefficient obtained for NHRPD. Private patients apparently prefer a lower occupancy level--or, equivalently, require greater access--as shown by the negative but not quite significant coefficient obtained for percentage private (PCTPRIV).

It is also noteworthy that the desired occupancy level does not vary significantly, ceteris paribus, with certification (i.e., SNF/ICF). This suggests that any occupancy penalties should be applied uniformly across certification levels if other relevant differences have already been taken account of in rate setting (e.g., by using a formula). However, the desired occupancy level is estimated to be significantly higher in for-profit (PROFIT) homes. This may reflect consumer preference for certain unobserved

differences between for-profit and non-profit facilities. On the other hand, even though we have sought to specify this OCCEN model as a demand-type relation, it is still possible that this result reflects supply behavior--e.g., the greater efficiency of for-profit facilities in maintaining occupancy. The negative, significant coefficient obtained for the percentage three-bed room variable (PTHREEB) suggests that consumers are willing to pay less for such accommodations, relative to staying in two-bed rooms.

The occupancy penalty (OCCUPEN) is neither positive as had been anticipated nor significant. However, it is possible that the effect of this variable is mediated via the NHRPD variable, as suggested in discussion of the service intensity models. However, this hypothesis is not supported by reduced-form estimation (see Section 4.3) in which the NHRPD variable is excluded. The implication may be that occupancy penalties are generally ineffectual--or, at least they were ineffectual at the time of the 1972-1973 NCHS survey. However, regulation has not been altogether ineffective in maintaining occupancy. The positive and highly significant coefficient obtained for the CON variable indicates that certificate-of-need programs have raised occupancy levels. Furthermore, this result is obtained, even after controlling for the county-wide bed-to-population ratio (BEDPOP) and consequently underestimates the total effect of CON programs, because the mechanism by which the CON program works is to decrease or limit growth in the aggregate number of nursing home beds.

4.2.4 The Inverse Supply Function

An inverse supply function is a function in which, instead of having the quantity supplied as a function of the supply price and other variables, the supply price is a function of quantity supplied and those other variables. (The two are formally equivalent.) This relation models the private price of care (PRIVRATE) and relates the price at which nursing home output will be supplied by a nursing home, given the regulatory and other constraints on its behavior, to characteristics of the output, input prices, etc. The results further substantiate the importance of simultaneity in understanding nursing home behavior. All three endogenous variables are significant at the .01 level or better. For example, the private rate is now found to be a significant function of occupancy; previously occupancy was shown above to be a significant function of the private price.

The results obtained with respect to reimbursement variables are especially interesting. The PM1, PM2 and LIM (retrospective rate, flat rate, and absolute rate ceiling) coefficients are all positive and significant. In particular, the PM1 (retrospective reimbursement) coefficient is almost equal in magnitude but opposite in sign to the PM1 coefficient obtained in the AOC equation. Although it is premature to draw any firm conclusion, these results strongly suggest that cost containment measures with respect to public patients have exerted upward pressure on the prices charged to private patients--that, at least in some degree, retrospective and flat rate reimbursement (relative to prospective reimbursement) and reimbursement ceilings have led to private patients subsidizing public patients. That is, those reimbursement parameters that have been shown to lower average costs (as defined by public accounting standards) are now seen to increase the rates charged to private patients.

4.2.5 The Relative Supply Function

The relative supply or access of nursing home care to public and private patients is modeled using percentage private (PCTPRIV) as the dependent variable. Here again, we find that rate setting has had an impact on a variable of interest besides cost. In particular, those features of rate setting that were earlier shown to confine costs--i.e., have negative coefficients in the AOC relation--are now found to reduce the relative access of public patients to nursing home care. Such an effect is to be expected. The lower the reimbursement offered for public patients in relation to the price bid by private patients--i.e., the lower the relative price of public patients--the greater will be the relative supply of beds to private patients. Of course, indirectly this has the effect of controlling aggregate reimbursement expense inasmuch as there are fewer publicly-reimbursed patients in nursing homes. The significant, positive coefficients on NHRPD and INDEX indicate that facilities providing a greater service intensity attract more private patients, on the average.

Several of the reimbursement variables are significant. In particular, the PM1 coefficient is significant and positive. This result implies that retrospective reimbursement, as compared to prospective reimbursement, reduced the access for public patients. Finally, we here find evidence that occupancy penalties (OCCUPEN) have had a beneficial effect for

public patients. It may be that facilities have boosted their occupancy levels by taking public patients and thereby altering the public-private patient mix.

4.3 The Reduced-Form Equations

The reduced-form equations are reported in Table 4-A.4. Formally, these equations are derived from the structural equations by solving for each of the endogenous variables so as to eliminate other endogenous variables from the right-hand side. The reduced form results show the net effect of both the direct and indirect consequences of each of the exogenous variables. That is, the reduced-form equations generally give the more policy-relevant information because reduced-form coefficients give the equilibrium impact of a change in any exogenous variable on any endogenous variable. For example, the PM1 coefficient in the AOC relation reflects not only the direct impact on cost but also its effect on the other endogenous variables and their effect on cost. That is, it reflects not only the direct impact of PM1 on average operating cost, but also its impacts on NHRPD, INDEX, PRIVRATE and PCTPRIV and their impact on cost. Likewise, the NHRPD relation reflects not only the direct effect of PM1 on nursing intensity but also its effect on other endogenous variables and their "feedback" effect on nursing intensity.

It seems likely that the rate setter will wish to "short-circuit" some of the structural effects and, for example, maintain service intensity thresholds by regulation or reimbursement incentive much as has been done with occupancy penalties. That is, the policy alternatives being considered in this study are not limited to the reimbursement and regulatory programs parameterized in the econometric work. Thus, we are not merely interested in the final effects but also in the mechanism by which those effects obtain. However, because of such "feedback" effects, it is difficult to gauge whether or not reduced-form results are consistent with expectations. This is more readily done in the context of the structural relations above. In fact, the validity of a reduced-form relation is most reliably tested by evaluating the reasonability of the structural model from which it derives. Finally, although the reduced-form coefficients may give the aggregate effect, it will be useful in designing a reimbursement system to also understand the structural process.

4.3.1 Reimbursement and Regulatory Variables

The reimbursement and regulatory variables have the greatest interest in this study. Retrospective (PM1) and flat rate (PM2) reimbursement, relative to prospective reimbursement, lowers the average operating cost level by $2.31 and $0.87 per patient-day, respectively. The former estimate is larger than that obtained earlier in single-equation estimation and the latter estimate is somewhat smaller. The PM1 coefficient is larger because prospective reimbursement leads to an increase in rehabilitative service intensity and this increases cost. The lower PM2 coefficient is due to the greater effect of flat rate reimbursement in the structural model on the private rate variable and its feedback effect on cost. Furthermore, both retrospective and flat rate reimbursement variables have significant negative coefficients in the INDEX relation. Apparently the greater effect of these reimbursement variables on rehabilitative services feeds back into the nursing intensity structural relation and "swamps" the significant structural effect of these reimbursement variables.

A limitation or ceiling (LIM) on reimbursement is found to reduce costs by $1.50 per day, compared to $0.89 in the structural relation. It has a similarly negative impact on nursing intensity. We attribute its (significant) positive coefficient in the INDEX relation to feedback from the NHRPD relation, much as was hypothesized above with respect to the PM2 variable. Finally, as was found in the structural relation, an absolute reimbursement ceiling is found to significantly reduce the access of public patients--proxied by PCTPRIV--to nursing home care. Such limitations widen the gap between private and public rates in some facilities and make it relatively more attractive to accept private patients.

Uniform accounting (UNIF) is found to significantly increase both operating costs and the private rate--the one by $2.41 per day and the other by $1.85. Although the magnitudes are comparatively large, we had anticipated that uniform accounting would involve some increment to cost. Nevertheless, it seems likely that the uniform accounting variable is actually proxying other uncontrolled regulatory differences between the states--e.g., states with uniform accounting may be more progressive in general.

4.3.2 Facility Variables

Rather than review the specific equations, we review the overall pattern of the more policy relevant results.

First, ICF certification, relative to SNF certification, implies a lower average operating cost (-$2.01), a lower nursing (-0.45 nursing hours

per patient-day) and rehabilitative service intensity, a lower occupancy (-2.2 percentage points), a lower private rate (-$2.50) and a smaller percentage of private patients (-7.4 percentage points).

The admissions per patient-day variable (ADMISPD) is found to have significant, positive effects on average cost and the two service intensity variables. These service results support earlier hypotheses that short-stay patients are more expensive because of their interest in being rehabilitated and consequent demand for services. A greater rate of patient turnover is also found to significantly reduce occupancy as one would expect. Furthermore, ADMISPD has the same positive (significant) relation to the private rate as it did to average operating cost. However, its coefficient is much smaller, perhaps because private patients do not involve the fixed paperwork and other expense that public patients do.

The for-profit (PROFIT) facilities are found to have significantly lower operating costs (-$1.50) but to charge a significantly higher rate to private patients (+$1.53). This suggests either that private patients are subsidizing public patients in for-profit facilities or that such facilities are earning excess profits on private patients. However, for-profit homes also have significantly fewer private patients (-7.8 percentage points). This is consistent with an earlier hypothesis that for-profit facilities provide fewer amenity-type services.

Contracting is again shown from the PCONTRCT variable to have a positive (significant) inpact on cost. The higher cost associated with contracting may explain contracting's negative effect on nursing intensity; ceteris paribus, there is a production-possibility tradeoff. Both cost money, and if a home has more contracting, at a given cost level, it must have less nursing services. The bed-room distribution variables (PONEB and PTHREEB) indicate, also consistent with earlier results, that a smaller number of patients per bed-room is more costly. The PRIVATE results further confirm that private patients are willing to pay a premium for more private rooms.

4.3.3 Patient Variables

The average patient age variable (AGE) is only significant in the percentage private (PCTPRIV) relation and implies that private patients tend to be older. A possible inference from this result may be that because the cost of care is actually paid by the patient or patient's family, private patients tend to defer entering a nursing home until later in life. If so, lack of co-insurance provisions in Medicaid coverage of nursing home care may

imply that over-utilization results. Whereas most of the debility coefficients are not quite significant at the .10 level, the partial debility variable (BEDPD) indicates that such debility implies increased service intensity (both NHRPD and INDEX), increased costs and a higher rate charged to private patients. Thus, results are consistent with expectations. In addition, partially disabled patients tend to be private-pay patients. This is consistent with our generic hypothesis above that private patients tend to defer entering a nursing home until they have greater "need." The patient diagnostic variables (PNOWDIG1-PNOWDIG13) are most significant in the AOC and INDEX relations. Patients with diagnosed illnesses are found to cost more but demand fewer rehabilitative services, perhaps because they are too incapacitated to use or benefit from them.

4.4 The Implications For Design of A Reimbursement Scheme

The results of the multi-equation model dramatize the importance of endogeneity concerns in nursing home reimbursement. A "black box" approach to rate setting is unsatisfactory. That is, rate setting is shown both conceptually and empirically to have unintended effects and lead to undesired consequences on variables of policy interest in addition to cost. Whereas "lip service" is often given to such possibilities, this study affirms that such possibilities must be taken seriously and that rational rate setting cannot proceed apart from a more comprehensive understanding of the nursing home behavioral environment. However, we do not go so far as to suggest that the present multi-equation modeling effort will furnish an adequate guide for that purpose. Although it certainly would be useful to continue multi-equation modeling efforts in this area, it would be more fruitful for shorter-term policy interests to promote a dialogue between rate setters and nursing home operators. It would be a mistake for rate setters to rely upon statistical analyses to "bridge" the informational gap. Whereas statistical analysis can be useful in illuminating certain partial questions, it cannot in any sense provide a complete and comprehensive guide to reimbursement policy.

Other significant insights learned from the multi-equation modeling effort include the following:

- The demand for nursing home care by private-pay patients is not price inelastic. By not confronting public patients with co-insurance or other cost controlling incentives, public reimbursement of nursing home care biases such care towards over-utilization vis-a-vis less expensive substitutes (e.g., home care).
- On the other hand, cost-controlling reimbursement features appear to have a negative impact on the access of public patients to nursing home care. Thus, it may be premature to focus on containing costs; the rates may already be too low to satisfy the existing demand for public care.
- Cost-controlling reimbursement features also imply reductions in service intensity, and by presumption, the quality of care. The rate setter must decide whether or not such reductions in service intensity and quality are desired.
- The lack of strong association between certain debility-type variables and the service intensity (and cost) of care raises serious questions about the quality of care being given to more debilitated patients. If the quality of care is in fact deficient for such patients, it will be especially important to develop a patient-centered reimbursement scheme that explicitly takes account of differential patient need.
- We have no strong evidence that occupancy penalties on other reimbursement criteria have had any impact on occupancy rates. However, we have some evidence that CON has increased occupancy levels. These finding are generally consistent with the view that the more usual problem is not excess capacity but rather excess demand.
- Private patients are paying higher rates than public patients to begin and cost-controlling reimbursement features increase the differential. If nursing homes are not earning excess profits, the implication seems to be that private patients are subsidizing public patients and the extent of subsidy is increased by effective reimbursement controls.

APPENDIX 4-A

Table 4-A.1

Multi-equation Variable Specification

Independent Variable	Dependent Variable: AOC	NHRPD	INDEX	OCCEN	PRIVRATE	PCTPRIV
NHRPD	X	—	X	X	X	X
INDEX	X	X	—	X	X	X
OCCEN	X	—	—	—	X	—
PRIVRATE	—	—	—	X	—	X
PCTPRIV	X	X	X	X	—	—
BEDS	X	X	X	X	X	X
CHANGE	X	—	—	X	—	—
ADMISPD	X	X	X	X	X	X
ICF	X	X	X	X	X	X
ICFSNF	X	X	X	X	X	X
PROFIT	X	X	X	X	X	X
CHAIN	X	X	X	X	X	X
PCONTRCT	X	X	X	—	X	X
PONEB	X	X	X	X	X	X
PTHREEB	X	X	X	X	X	X
AGE	X	X	X	—	X	—
PFEM	X	X	X	—	X	—
BEDPD	X	X	X	—	X	—
BEDD	X	X	X	—	X	—
PNOWDIG1	X	X	X	—	X	—
PNOWDIG2	X	X	X	—	X	—
PNOWDIG3	X	X	X	—	X	—
PNOWDIG4	X	X	X	—	X	—
PNOWDIG5	X	X	X	—	X	—
PNOWDIG6	X	X	X	—	X	—
PNOWDIG7	X	X	X	—	X	—
PNOWDIG8	X	X	X	—	X	—
PNOWDIG9	X	X	X	—	X	—
PNOWDIG10	X	X	X	—	X	—
PNOWDIG11	X	X	X	—	X	—
PNOWDIG12	X	X	X	—	X	—
PNOWDIG13	X	X	X	—	X	—
DEATH	X	X	X	—	X	—
PM1	X	X	X	—	X	X
PM2	X	X	X	—	X	X
LIM	X	X	X	—	X	X
OCCUPEN	X	X	X	X	X	X
UNIF	X	X	X	—	X	—
LSC	X	X	X	X	X	—
MA	X	—	—	—	—	X
CON	X	—	—	X	—	—
STAFFA	X	X	—	—	—	—
STAFFB	X	X	—	—	—	—
SMSA	X	X	X	X	X	X
WAGE	X	X	X	—	X	—
PCI	X	X	X	X	—	X
CONC	X	—	X	X	—	X
BEDPOP	X	X	X	X	—	X
(Constant)	X	X	X	X	X	X

Table 4-A.2

VARIABLE DEFINITIONS: NATIONAL ANALYSIS

AOC	Operating costs per patient day, i.e., all annual non-capital costs per patient day that could be avoided ony by completely closing the nursing home divided by the number of annual patient days provided
NHRPD	Average number of nursing hours provided per patient day
INDEX	Index of services provided by nursing home, equal to average percentage of patients receiving one or more of the following services in the past seven days: counseling, nasal feeding, blood pressure reading, enema, catheterization, full bed bath, bowel and bladder retraining, application of dressing, temperature-pulse respiration, irrigation, intravenous feeding
OCCEN	Percentage of beds occupied by patients
PRIVRATE	Average per diem rate charged for private patient
PCTPRIX	Percentage of total patient days provided to private patients
BEDS	Number of beds in facility
CHANGE	1 = Bed size of home changed in past 12 months 0 = Otherwise
ADMISPD	Number of patients admitted in 1972 divided by annual patient days
ICF	1 = Type of certification is ICF only 0 = Otherwise
ICF-SNF	1 = Type of certification is Medicare & ICF, SNF & ICF, or Medicare, SNF, & ICF 0 = Otherwise
PROFIT	1 = Individual, partnership, or corporate ownership 0 = Otherwise
CHAIN	If the home is not government owned, this variable indicates whether facility is a member of a group of homes operating under one general authority or general ownership 1 = Yes 0 = No
PCONTRACT	Percentage of operating costs met by contracting with outside group

PONEB	Percentage of rooms with one bed
PTHREEB	Percentage of rooms with three beds
AGE	Average age of patients in the home
PFEM	Percentage of female residents on night prior to the survey
BEDPD	Percentage of patients who need assistance on moving in and out of a bed or chair
BEDD	Percentage of patients who are bedfast
PNOWDIG1	Percentage of depressed patients
PNOWDIG2	Percentage of agitated and nervous patients
PNOWDIG3	Percentage of abusive and aggressive patients
PNOWDIG4	Percentage of confused and senile patients
PNOWDIG5	Percentage of patients with disturbed sleep
PNOWDIG6	Percentage of patients with diagnosis: hardening of the arteries
PNOWDIG7	Percentage of patients with diagnosis: stroke
PNOWDIG8	Percentage of patients with diagnosis: accidents, poisonings, and violence
PNOWDIG9	Percentage of patients with diagnosis: endocrine, nutritional, and metabolic diseases
DEATH	The number of patient deaths in 1972 divided by the census on the night prior to survey
PM1	1 = Type of payment mechanism was cost related (either reasonable, actual, or retrospective)
PM2	0 = Otherwise 1 = Type of payment mechanism was flat rate (incl. pts.) 0 = Otherwise
LIM	Indicates presence of absolute limits on administratiave salaries and/or payments 1 = Yes 0 = No

OCCUPEN	Indicates presence of occupancy penalties 1 = Yes 0 = No
UNIF	Indicates the requirement of maintaing a uniform chart of accounts 1 = Yes 0 = No
LSC	Life Safety Codes were in effect in 1972 1 = Yes 0 = No
MA	Indicates time of patient assessment relative to admission 1 = Pre 0 = Post
CON	Indicates status of the Certificate of Need Program 1 = Functioning 1972 0 = Not functioning
STAFFA	Indicates the requirement that an RN or LPN be present irrespective of the size of the home 1 = Yes 0 = No
STAFFB	Number of nurses required per (SNF/ICF adjusted) patient day for the day shift
SMSA	1 = Not located in SMSA 0 = Located in SMSA
WAGE	1973 average retail wage in the nursing home's county (taken from Area Resource File)
PCI	Percapita income in county in which facility is located
CONC	Measure of concentration of nursing home beds in county, equal to ratio of nursing home beds in facility divided by the nursing home beds in county
BEDPOP	Ratio of nursing home beds in county to population in county

Table 4-A.3

Structural Equations
(standard errors in parentheses)

Independent Variable	Dependent Variable AOC	NHRPD	INDEX	OCCEN	PRIVRATE	PCTPRIV
NHRPD	3.29(.180)***	--	-1.36(.485)**	7.82(1.77)***	12.3(2.15)***	14.7(3.90)***
INDEX	.543(.0997)***	-.218(.144)	--	.658(.765)	3.58(.720)***	4.51(2.34)*
OCCEN	-.0274(.0160)*	--	--	--	.536(.0927)***	--
PRIVRATE	--	--	--	-.565(.235)**	--	.345(.482)
PCTPRIV	-.0201(.00615)***	.0224(.0150)	-.0123(.0174)	-.0679(.0462)	--	--
BEDS	.00781(.00224)***	.000992(.00077)	.00447(.00067)***	-.0131(.00520)**	-.00350(.00370)	-.0211(.0144)
CHANGE	-1.98(1.13)*	--	--	-20.3(2.47)***	--	--
ADMISPD	185.8(42.7)***	96.9(8.35)***	154.4(46.0)***	-1420.7(160.0)***	-833.0(184.2)***	-1142.1(375.8)***
ICF	-.0111(.447)	-.600(.291)**	-2.07(.217)***	.515(1.49)	8.56(2.03)***	6.63(3.80)*
ICFSNF	.212(.383)	.0311(.182)	-.530(.178)***	.144(.839)	1.40(.554)**	-5.98(1.94)***
PROFIT	-1.36(.444)***	.0906(.151)	-.296(.182)	1.90(1.05)*	1.94(.454)***	-7.10(2.42)***
CHAIN	-.238(.304)	.0363(.0528)	.0980(.0946)	.280(.581)	-.122(.328)	-.642(1.54)
PCONTRCT	.0792(.0361)**	.00312(.00704)	.0224(.0117)*	--	.0880(.041)**	-.190(.203)
PONEB	.0500(.0101)***	-.0116(.005)**	-.00294(.00748)	.00952(.0269)	.0412(.0151)***	.421(.0493)***
PTHREEB	-.0311(.0175)*	.00906(.00377)**	.0128(.00663)*	-.0872(.0382)**	-.0600(.0202)***	-.321(.0925)***
AGE	-.0165(.0353)	-.0124(.00951)	.00239(.0143)	--	.0243(.0346)	--
PFEM	-.0115(.0122)	.000309(.00503)	.0183(.00542)***	--	-.0564(.0196)***	--
BEDPD	-.00194(.00817)	.00334(.00246)	.0117(.00317)***	--	-.0589(.0150)***	--
BEDD	-.0132(.0172)	.00324(.00400)	-.00540(.00610)	--	-.0373(.0184)**	--
PNOWDIG1	.0432(.0184)**	.000930(.00434)	-.0110(.00615)*	--	.0244(.0189)	--
PNOWDIG2	.0541(.0219)**	.00125(.00566)	-.0142(.00740)*	--	.0818(.0239)***	--
PNOWDIG3	.0409(.0195)**	.00341(.00398)	-.00441(.00659)	--	.0244(.0198)	--
PNOWDIG4	.0318(.0170)*	.00627(.00473)	-.00637(.00715)	--	-.0158(.0192)	--
PNOWDIG5	.00773(.0267)	.00205(.00648)	-.0154(.00900)*	--	.0188(.0274)	--
PNOWDIG6	.0191(.0248)	.00252(.00431)	-.00169(.00794)	--	.0182(.0255)	--
PNOWDIG7	.00302(.0188)	-.00152(.00409)	-.0133(.00582)**	--	.0518(.0208)**	--
PNOWDIG8	.0263(.0232)	.000638(.00554)	-.0149(.00765)*	--	.480(.0248)*	--
PNOWDIG9	.0158(.0270)	.000619(.00696)	-.0196(.00912)**	--	.0586(.0296)**	--
PNOWDIG10	.0646(.0334)*	-.00259(.00634)	-.0156(.0103)	--	.0472(.0341)	--
PNOWDIG11	.0430(.0339)	.00128(.00576)	.00208(.0104)	--	-.0278(.0334)	--
PNOWDIG12	.0125(.0233)	.00721(.00553)	-.00334(.00872)	--	.0191(.0232)	--
PNOWDIG13	.0752(.0356)**	-.00287(.00717)	-.0189(.0112)*	--	.139(.0412)***	--
DEATH	2.52(.809)***	-.233(.194)	.185(.302)	--	6.60(1.08)***	--
PM1	-1.74(.456)***	-.200(.0760)***	-.415(.143)***	--	1.39(.521)***	4.32(2.31)*
PM2	-.497(.485)	-.132(.125)	-.601(.150)***	--	2.24(.783)***	.452(2.65)
LIM	-.894(.512)*	-.239(.133)*	.0808(.207)	--	1.17(.563)**	7.08(2.49)***
OCCUPEN	.473(.460)	.336(.157)**	.248(.244)	-.532(.946)	--	-14.1(2.17)***
UNIF	2.04(.415)***	.0635(.125)	.503(.123)***	--	-.977(.650)	--
LSC	-.499(.367)	.175(.112)	.648(.127)***	.474(.748)	-3.46(.726)***	--
MA	-.280(.448)	--	--	--	--	.110(2.20)
CON	2.43(.449)***	--	--	2.464(.847)***	--	--
STAFFA	2.37(.554)***	-.123(.125)	--	--	--	--
STAFFB	2.99(1.63)*	.457(.322)	--	--	--	--
SMSA	-1.06(.354)***	.00616(.113)	-.408(.124)***	-.337(.757)	-.938(.430)**	-.779(2.06)
WAGE	-.279(.466)	.107(.0835)	.323(.148)**	--	-3.12(.568)***	--
PCI	-.000105(.00029)	.0000392(.00005)	.000120(.00009)	-.000107(.00051)	--	-.00122(.00133)
CONC	-.339(.528)	--	.220(.195)	1.67(1.10)	--	-5.94(2.88)**
SEDPOP	-.000592(.00877)	.000490(.00194)	.00604(.00276)**	-.0297(.0150)**	--	.0404(.0403)
(Constant)	5.51	2.37	4.30	86.1	-69.0	-2.54
R^2 Adj.	.55751	.33423	.41991	.21772	.34772	.23934
R^2	.53824	.30967	.39854	.20357	.32494	.22489
Std. Error	4.84636	.82114	1.48724	9.25572	4.76922	24.38839
Residual Sum of Squares	25342.74263	731.57925	2402.08890	94749.12182	24747.10084	657247.0416

* significant at .10 level
** significant at .05 level
*** significant at .01 level

Table 4-A.4

Reduced Form Equations
(standard errors in parentheses)

Independent Variable	Dependent Variable AOC	NHKPD	INDEX	OGCEN	PRIVRATE	PCTPRIV
BEDS	.0105(.00253)***	-.0000167(.00037)	.00442(.0006)***	-.0156(.00415)***	.00389(.00209)*	.00436(.0108)
CHANGE	.127(1.28)	.632(.186)***	-.356(.337)	-.15.1(2.10)***	-1.47(1.06)	9.72(5.45)*
ADMISPD	525.0(44.3)***	95.2(6.43)***	22.7(11.6)*	-621.5(72.6)***	86.6(36.6)**	153.4(188.1)
ICF	-2.01(.485)***	-.449(.0705)***	-1.35(.127)***	-2.22(.795)***	-2.50(.401)***	-7.36(2.06)***
ICFSNF	-.610(.439)	-.152(.0637)**	-.187(.115)	-.0397(.718)	-.916(.362)**	-10.1(1.86)***
PROFIT	-1.50(.513)***	-.0643(.0746)	-.0788(.135)	1.37(.841)	1.53(.424)***	-7.81(2.18)***
CHAIN	-.0986(.354)	.0445(.0514)	.0259(.0929)	.209(.579)	.497(.292)*	.741(1.50)
PCONTRCT	.0726(.0418)*	-.0101(.00606)*	.0165(.0110)***	-.0876(.0684)	.0430(.0345)	-.220(.177)
PONEB	.0304(.0115)***	-.00403(.00167)**	-.00114(.00302)	-.326(.0188)*	-.0330(.00948)***	.329(.0487)***
PTHREEB	-.0141(.0203)	.00176(.00294)	.0114(.00533)**	-.0311(.0332)	-.0323(.0168)*	-.207(.0861)**
AGE	-.0325(.0409)	-.00107(.00594)	-.00130(.0108)	.0490(.0670)	.0287(.0338)	.518(.174)***
PFEM	.00167(.0141)	.00431(.00204)**	.00865(.00369)**	.00731(.0230)	.0264(.0116)**	.275(.0597)***
BEDPD	.0143(.00943)	.00496(.00137)***	.00373(.00248)	.00302(.0154)	.0193(.00778)**	.100(.040)**
BEDD	-.00783(.0211)	.00169(.00307)	-.00577(.00555)	.0531(.0346)	-.0142(.0175)	-.121(.0898)
PNOWDIG1	.0422(.0214)**	.000757(.00311)	-.0102(.00563)*	.00117(.0351)	-.00352(.0177)	-.101(.0910)
PNOWDIG2	.0500(.0254)**	-.000817(.00369)	-.0109(.00668)	-.0766(.0417)	.0103(.0216)	-.191(.108)*
PNOWDIG3	.0493(.0226)**	.00342(.00328)	-.00857(.00594)	-.0115(.0371)	.0250(.0187)	-.0774(.0960)
PNOWDIG4	.0445(.0197)**	.00487(.00287)**	-.0108(.00518)**	.0174(.0323)	.0107(.0163)	-.151(.0838)*
PNOWDIG5	.00529(.0310)	.000438(.00450)	-.0129(.00813)	.0282(.0507)	-.0106(.0256)	-.193(.132)
PNOWDIG6	.0312(.0288)	.00508(.00418)	-.00807(.00756)	-.0215(.0472)	.0338(.0238)	.0377(.122)
PNOWDIG7	-.00350(.0218)	-.000466(.00317)	-.0119(.00573)**	-.00901(.0357)	-.00633(.0180)	-.0624(.0926)
PNOWDIG8	.0242(.0269)	.000575(.00391)	-.0139(.00707)**	-.0201(.0441)	-.000122(.0222)	-.149(.114)
PNOWDIG9	.00991(.0314)	-.000576(.00456)	-.0159(.00825)*	-.0101(.0514)	-.0120(.0259)	-.216(.133)
PNOWDIG10	.0533(.0389)	-.00180(.00564)	-.0115(.0102)	.0282(.0636)	-.00777(.0321)	-.0805(.165)
PNOWDIG11	.0436(.0395)	-.00103(.00573)	.00527(.0104)	.0107(.0647)	-.0172(.0326)	-.0667(.168)
PNOWDIG12	.0235(.0271)	.00236(.00394)	-.00410(.00712)	-.0328(.0444)	.0131(.0224)	-.230(.115)**
PNOWDIG13	.0633(.0414)	-.00353(.00602)	-.0119(.0109)	-.109(.0679)	-.0111(.0342)	-.158(.176)
DEATH	2.17(.933)**	-.166(.136)	.313(.245)	-5.78(1.53)***	2.56(.771)***	6.58(3.96)*
PMI	-2.31(.529)***	-.0859(.0768)	-.404(.139)***	.548(.866)	-1.67(.0437)***	2.26(2.25)
PMI2	-.872(.561)	-.0454(.0815)	-.565(.147)***	-1.05(.919)	-.132(.463)	-2.59(2.38)
LIM	-1.50(.590)**	-.236(.0857)***	.417(.155)***	-1.54(.966)	-1.59(.487)***	5.06(2.50)**
OCCUPEN	1.09(.529)**	.0701(.0768)	.261(.139)*	-1.04(.866)	1.23(.437)***	-10.6(2.25)***
UNIF	2.41(.481)***	.0782(.0699)	.373(.126)***	.0394(.788)	1.85(.397)***	4.10(2.04)**
LSC	.176(.423)	.184(.0614)***	.317(.111)***	1.08(.693)	.213(.349)	3.64(1.80)**
MA	-.596(.514)	-.210(.0747)***	.613(.135)***	-.219(.843)	-.927(.425)**	-1.74(2.18)
CON	2.61(.522)***	.0700(.0758)	-.131(.137)	.761(.855)	3.51(.431)***	-2.10(2.22)
STAFFA	2.51(.642)***	.143(.0932)	-.355(.169)**	.0248(1.05)	2.37(.530)***	6.75(2.73)**
STAFFB	3.15(1.89)*	-.1147(.274)	.835(.496)*	7.90(3.10)**	1.43(1.56)	-15.1(8.03)*
SMSA	-1.12(.409)***	.0383(.0594)	-.429(.107)***	.258(.669)	-1.47(.337)***	-2.97(1.74)*
WAGE	.100(.541)	.102(.0786)	.179(.142)	1.70(.887)*	-.276(.447)	.286(2.30)
PCI	.000215(.00033)	.0000178(.00005)	.0000807(.00009)	-.000212(.00054)	.000389(.00027)	-.0000915(.00141)
CONG	-.597(.609)	-.194(.0884)**	.510(.160)***	1.01(.997)	.234(.503)	-6.43(2.58)**
BEDPOP	.00341(.0102)	.000435(.00148)	.00500(.00267)*	-.0207(.0167)	.00166(.00841)	.0356(.0432)
(Constant)	10.3	1.93	1.55	89.9	9.21	-2.64
R^2 Adj.	.373	.311	.402	.205	.354	.251
n_2	1127	1127	1127	1127	1127	1127
R^2	.39718	.33745	.42479	.23526	.37951	.27962
Std. Error	5.64621	.81990	1.48301	9.24802	4.66230	23.97385
Residual Sum of Squares	34525.66316	728.03705	2381.87318	92624.51308	23541.18762	622449.12727

* significaot at .10 level
** significant at .05 level
*** significant at .01 level

CHAPTER 5*

AN EXAMINATION OF THE REIMBURSEMENT OF NURSING HOMES

5.0 Introduction

This chapter explores in a conceptual manner how the results of reimbursement system may be affected by the characteristics of the nursing home industry.[1] That is, there are certain hypothesized constraints which have to be considered in constructing a reimbursement system. For example, it may be that a reimbursement system, to be politically successful, will be structured in terms of full cost rather than demand price. In addition, reimbursement plans deal with inputs and intermediate outputs such as "patient-days" rather than final output measures. Realistic reimbursement systems are necessarily as much concerned with equity or "fairness" issues as they are with efficiency. The initial section of this chapter (5.1) offers a rationale as to why these and other results can be expected to dominate thinking about the parameters of nursing home reimbursement systems, although some analysts would consider the above results undesirable. That is, on normative grounds, some would argue that reimbursement should include specific considerations of the underlying willingness to pay, that final outputs should be valued rather than intermediate ones, that prices are allocative devices which should be concerned with efficiency issues, and that equity concerns are best taken into account by explicit income redistribution programs.

The definition of these objectives is particularly relevant. Consider the meaning of equity. If equity refers to treatment of providers, then equity could be interpreted in terms of the cost of patient treatment such that each provider's costs should be reimbursed according to the differential costs of patients of different debility and hence cost plus reimbursement could be considered equitable. In contrast, if equity refers to a more sociological notion of treating all patients alike whatever their debility, then equity

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[1]This discussion is limited to short-run behavior in the sense that it ignores capital cost and investment issues. These concerns were outside the scope of work of this study. Throughout this chapter, the term "costs" refers to "operating costs."

implies more of a flat-rate notion of reimbursement. Nevertheless, it is realistic to expect that reimbursement systems will not take into account willingness to pay, will continue to concentrate on intermediate outputs, will use input standards, and have amorphous equity objectives. The question is what can be done in such a "second best" situation to move the nursing home industry uphill toward a point preferred over where it is today.[1] The later sections of the chapter (5.2-5.4) consider policy options for dealing with these constraints. The prototype reimbursement system discussed in Chapter 6 is designed in this context.

5.1 Constraints on Policy Options: Public Price Setting in the Nursing Home Industry

The nursing home industry can be characterized by "sticky" prices and imperfect markets, as well as heterogeneous production methods and output. Nursing home care varies widely in its content and quality and the output is not produced homogeneously. Other market characteristics include widespread ignorance about what constitutes good nursing home care, aged and senile consumers who are not in a position to make difficult choices or to relocate to another home if the first home is unsatisfactory, and the general absence of doctors from the nursing home scene. Moreover, the nursing home operator within his locality is either a monopolist or an ologopolist. While such factors are present in the general nursing home market, some might argue that the market mechanism still operates for private patients, particularly in terms of price competition. While the market might partially operate elsewhere, the Medicaid market combines the previous problems with a pricing mechanism embeded in the political/budgetary administrative process in a fashion that eliminates or severely reduces market pressures.

Nursing home operators in this environment can be characterized as having some degree of control over the rates that public agencies pay for care to public patients. As discussed below, this control results in behavior that effects the type of reimbursement that is feasible and the responses that nursing home operators have to reimbursement schemes. The

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[1] The reimbursement system must be used in tandem with the regulatory system. There are tradeoffs; the reimbursement system may do better than a regulation at gaining certain objectives, and vice versa. The reimbursement system alone can be expected to have a limited impact; price after all is only one of a number of variables interacting with a complex and interrelated world; its effect and importance is augmented as a policy tool because of the tradeoffs that can be exercised with the reimbursement system. A discussion of some of these tradeoffs is undertaken in this chapter.

rate setting agency may feel that it is setting the public rate. But it should be recognized that when the rate is based on notions of cost-relatedness, nursing home operators in the aggregate have control over the rate to the extent that they choose their costs and that their costs are reflected in the rate. Clearly, the price setting behavior of nursing homes is shared with public agencies that purchase large amounts of nursing home services, and thus the nursing home operator is not a complete price maker. However, it would be erroneous to posit that the government sets prices apart from the concerns of the nursing homes.[1] The characteristics of the nursing home market together with the manner in which rates are set on a cost-related basis result in a situation in which prices are constrained to approximate cost.

The operational reason why nursing home operators have some degree of control over the reimbursement rate in that their public prices are based on cost stems from the nature of the historical reimbursement policies of the state and federal government. For the most part, nursing home reimbursement rates or prices for public patients are set by administrative fiat which requires that the public price be related to the costs incurred by the nursing

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[1] Noll's comments with regard to the environment of regulation is appropriate at this point. He writes (1976, p. 9)

> . . . The information presented to a regulatory authority during its deliberations is likely to come almost exclusively from special interests. In addition, only those special interests will usually pose a serious threat to appeal the agencies' decisions to the courts or the legislature. All these factors cause regulators to devote most of their attention to the effects of their policies on regulated firms and other well represented special groups. First, the information flowing to the agency will be systematically biased against unrepresented groups as a natural consequence of the advosary system. Second, to minimize that the chance of being overturned by the courts or the legislature, the agency will be inclined to make the decisions that somewhat favor represented groups. . . . The contact regulators have with legislature is generally restricted to a few members of subcommittees that oversee the agencies programs and budget--a relatively small proportion of the total legislature. Policies that contribute to the reelection of a few subcommittee members may not necessarily be those that could gain majority support in the legislature, yet they may be instituted in any event through the informal relations between regulators and the subcommittee members.

home operator. Such methods essentially take total allowable cost expenditures divided by the number of patient-days and define it (plus a profit factor) as equal to the rate of reimbursement per patient day of nursing home care. A large variety of procedures exist which define exactly what incurred costs may be considered as "allowable" or "reasonable." Typical procedures which define maximum ceilings for these costs are discussed at more length in Section 5.2. While the specifics may differ under alternative reimbursement systems, the basic procedure of deriving reimbursement rates from allowable average costs is the same.

The alternative procedure which was formerly used in certain states was a flat rate system. Flat rate systems specified the rate for a particular period as equal to a single rate common to all facilities in a particular group. The practice under flat rate systems was to negotiate or legislate a rate without particular reference to the costs of nursing home care. Rather, the state typically set the rate in relationship to its budget availability. If there were $X available for nursing home care and expected total patient days equaled Y, then the flat rate was $X/Y per patient day. One widely perceived consequence of such systems was low reimbursement rates that did not cover the cost of providing quality care. Public Law 92-603 forbid such systems and mandated that all state Medicaid plans provide for rates set on a "reasonable cost-related basis."

The point is that both nursing home operators and the government appear to accept that the rate should be related to cost. While nursing home operators would prefer to receive a very high rate in excess of their costs, they recognize the predilection of the government to set low rates. Thus, it appears that many nursing home operators perceive that a cost-based reimbursement system which will cover their costs will allow them a higher return than a flat-rate reimbursement system.

Such cost-based procedures for arriving at price are in contrast to the usual economic notion of price resulting from the interaction of supply and demand forces. The essence of the economist's notion is that an entrepreneur will set his output in accordance with relationships between marginal cost (the cost of an additional unit of output--which usually is <u>not</u> equal to the average cost of a unit of output) and marginal revenue (the revenue from an additional unit of output--which, again, is usually <u>not</u> equal

to the average revenue or price of a unit of output). Under certain circumstances, such behavior leads to a set of desirable properties, such as profit maximization, efficient production, and an optimal use of resources. Such behavior clearly is absent in the nursing home industry. In brief, the distinction is that in the nursing home industry the accountant makes his assignment of direct cost in terms of separate bookkeeping items rather than in contributions of cost to additional marginal output. The nursing home operator cannot be said to choose combinations of price and output, but rather produces an output in line with the number and mix of his patients at a price (i.e., reimbursement rate) commensurate with his costs.

The interaction of the public and private patient nursing home markets should be noted. While prices charged to private patients are not set by the government, private prices need not reflect the amount that private patients are willing to pay for a day of care. In part, this is because of the automatic conversion of patients from private pay to Medicaid status when their funds run out. Since their long-run price as public patients is zero, private patients may be willing to pay a higher short-run price to get into the nursing home of their choice. In brief, the rate charged to private patients is partially a function of the public rate.[1]

Cost-based principles of pricing for public patients lead to two sets of consequences: 1) non-price competition, which in the nursing home context leads to quality variations, and 2) when combined with excess demand situations, cost based reimbursement leads to cost inflation, irrespective of whether the reimbursement system is retrospective or prospective. These points are discussed below in Sections 5.1.1 and 5.1.2.

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[1] It can also be argued that a rate setting system that provides cost-based payments for public patients subsidizes the effort of homes oriented to provide mainly private-pay care to increase services to private patients. Facilities start out with different private demand curves due to facility characteristics like age of facility, physical plant location, and reputation which cannot easily be altered in the short-run. In this way they come to different decisions about which average cost curve they will operate on and what mix of public and private patients they will serve. A rate setting system that guarantees cost-based payments for public patients subsidizes the effort of high private demand homes to increase services to private patients and thus, to increase total profit on private patients; if the Medicaid patients were not there to fill the facility at a rate equal to average cost, it would not be able to offer such a high service level and would have to attract private patients through a lower price.

5.1.1 Non-Price Competition

One consequence of cost-based prices is the existence of non-price competition. Where prices are flexible, economists find that non-price competition is nearly absent. In contrast, non-price competition includes quality variations with little or no price variation. For example, the hospital industry has been characterized by Cromwell (1976) and others in terms of non-price competition. In that particular case non-price competition has led to quality augmenting competition. It is also possible, however, to compete by offering a definitely worse quality product at the same price; this, of course, results directly in more profit and may be encouraged insofar as the government forces nursing homes into a loss avoidance policy. This is especially possible in times of excess demand where it can be expected that patients will be in a position whereby they or their surrogates will be willing to pay prices that are in excess of the value of the product delivered. In brief, the extent to which it is a buyer's or seller's market will shift the whole quality scale up or down. Although both the buyer or seller like to pretend that nothing has happened, fairly radical shifts can take place without large price changes. Where the price is administered and is a result of a long-term agreement (such as under public reimbursement programs), minor fluctuations in supply and demand can express themselves in this manner.

To make the point alternatively, it is administratively convenient for public agencies to allow the nursing home operator to vary quality while the government maintains its price. Operators who set their price on the basis of cost tend to adjust their output and quality more readily than price. Thus, rate setters are plagued by the problem of how to associate price and quality and administer rates such that the relationship is maintained. The short-term response of the public sector has been to insist upon input standards which theoretically put a floor under the quality of services that are provided by nursing homes. In fact, the results of the multi-equation model suggest that they appear to have only a minor impact in terms of quality but do raise the cost of nursing home care; since input standards limit the range of production choices that operators can make, some efficient production possibilities are defined away.

5.1.2 The Relationship Between Cost Inflation, Excess Demand, and Reimbursement

For the most part, nursing home care is an entitlement program for low income and (to a lesser extent) aged individuals. As discussed below, this situation leads to excess demand for nursing home care; excess demand in conjuction with cost-based reimbursement system, results inevitably in cost inflation.

Given that a person is poor, there are few constraints to obtaining full Medicaid reimbursement for nursing home care. Further, there is no co-insurance provision for nursing home care under the Medicaid program. A number of consequences stem from this entitlement to zero-priced care. The most obvious consequence is that there is a very large quantity demanded of nursing home care. A derivative of such demands is the rapid growth of governmental expenditures for nursing home care. Two courses are open to federal and state governments for containing aggregate budgetary expenditures. The first is to restrict the eligibility of public patients; these restrictions have taken the form of, for example, increased income and demographic requirements for Medicaid programs. While eligibility restrictions have been tightened, such direct actions can be pushed only so far before undesirable political consequences result. A second and less obvious form of cost containment also has been adopted--reducing or maintaining low, administered reimbursement rates for public patients.[1] Low rates administered by the state in the form of cost ceilings serve to deter construction of additional bed capacity and keep the nursing home industry from expanding and contain program expenditures to meet the costs incurred by filling only existing beds.

The above scenario is consistent with the existing lengthy queues for nursing home beds in most nursing homes, e.g., 72 percent of all homes maintain waiting lists (USDHEW, NCHS, 1975). In brief, queues in the nursing home industry are an artifact of public policy. Supply constraints induced by price restrictions together with a zero out-of-pocket price to nursing home patients generate a situation characterized by excess demand; the quantity of beds demanded is greater than the quantity of beds supplied.[2]

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[1] Certificate of Need programs also may restrict the supply of beds.

[2] Of course, if reimbursements were set sufficiently high as to bring forth a supply of beds commensurate with the quantity demanded of patient days at a zero out-of-pocket price, excess demand conditions would not exist.

It is hypothesized that these queues, in part, serve the interests of the government. Patients not in nursing homes cannot incur nursing home expenses and queues serve to assist the budget control of the Medicaid nursing home program. Further, queues serve to impose a non-monetary price on otherwise free care in the form of the costs of waiting time for placement.[1]

Other consequences of excess demand are notable. While nursing home operators would rather see the price bid up, given that the price is fixed, queues represent security; there is always a patient to fill an empty bed. Further, the operator can choose those patients (from a range of potential patients) who require less care than more debilitated patients (who require more care and probably greater costs).[2] Finally, low reimbursement rates may translate into low quality of care. To economize on scarce resources and dollars, nursing home operators try to maintain costs commensurate with reimbursement rates and so may cut quality.[3] Other consequences may include fraud and abuse by nursing home operators who are attempting to maintain profit margins.

5.1.2.1 Cost Inflation

The existence of excess demand in the nursing home sector when combined with the cost-based pricing of nursing home operators has resulted

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[1] It may seem anomalous that queues are considered a form of budget control insofar as some of the persons in the queue are waiting in expensive hospital beds. This becomes less of a puzzle to the extent that the administrators of nursing home reimbursement systems perceive this as not being a cost to them because the hospital costs do not come out of their budget nor is hospital utilization of interest to nursing home rate setters. Their performance, it is hypothesized, is measured on how well they administer a given nursing home program and not their contribution to the optimal distribution of patients between Medicaid nursing home programs and other programs and between different types of vendors.

[2] In addition, the queue may help to keep private prices higher than public prices because, it may be hypothesized, the ability to pay private prices for even a short while may move a person ahead in the queue. This becomes especially possible to the extent that Medicaid will take over payment for daily patient cost after private resources are exhausted.

[3] Of course, some nursing homes do provide quality care, and higher rates need not be translated into improved quality. Nor are low rates the only cause for low quality. The point here is that low rates serve as a quality constraint. In consequence, in terms of absolute standards of need, reimbursement rates--at least in some states--may be far too low to cover the costs of supplying "needed" care.

in rapid increases in nursing home costs. The general discussion of price inflation in the nursing home industry has been to blame it on the profligate behavior of nursing home administrators. Furthermore, this behavior is felt to be encouraged by retrospective mechanisms of payment. That explanation is undoubtedly too simple. However, the nursing home operator can be a causal factor in wage price spiral. A critical decision of a nursing home operator is whether, given the opportunity to change prices, he should attempt to pass on any cost increases or absorb them at the risk of lower profits. It need not be the case that inflationary cost increases are necessarily passed on to a consumer. However, if excess demand is present it can be expected that cost increases will be passed on, for there is no reason for operators to cut their profit levels. It should be emphasized that excess demand and too low prices to consumers are required to allow the inflationary mechanism to work; for otherwise, the operator would need to augment the quantity demanded of his product.

Under this scenario the government too becomes a factor in the inflation process by fostering excess demand and allowing the cost-based nursing home operator to pass on cost increases. The nursing home industry is clearly characterized by excess demand at current rates of reimbursement and the failure to eliminate excess demand is a current difficulty in the industry.[1] Thus, the combination of excess demand and a price setting industry results in price inflation. Without excess demand, the firm either will absorb the cost increase or accept the expected lower profit due to reduced patient-days of care. Given that both the government and the nursing home view the reimbursement rate as constrained to approximate average cost, the crucial decision is between cost-pass-through and absorbtion. In brief, it is hypothesized that it is not simply the form of reimbursement--whether retrospective or prospective[2]--that has a significant impact on price

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[1] Low public rates serve to curtail the supply of public care. Increasing the reimbursement rates would lead to an augmented supply of care, reduced queues, and increased costs.

[2] A prospective rate setting system, as defined by Dowling (1974, p. 163), is a method of paying nursing homes and hospitals "in which (1) amounts or rates of payment are established in advance for the coming year; and (2) hospitals (. . . and nursing homes . . .) are paid these amounts or rates regardless of the costs they actually incur." Under a retrospective reimbursement system, rates are established after-the-fact for the previous year.

control. There are prior considerations: the degree to which excess demand exists in the industry and the degree to which cost based reimbursement is incorporated in the reimbursement system.

To summarize, there are three constraints embeded in the current system which serve to constrict the states from meetng their policy objectives: 1) patients are to incur no out-of-pocket costs; 2) patients have freedom of choice; and 3) reimbursement is to be cost-related. Under this system, there may be little that states can do to constrain costs. Of course, such a situation could be changed by altering current legislation, as for example, if patients had to pay coinsurance. Without such legislative change and since both prospective and retrospective systems are similar in that they are cost-based, both can be hypothesized to have about the same cost containing impact. The available empirical evidence supports this hypothesis. These issues are discussed below.

5.1.2.2 Prospective Reimbursement

The discussion here is concerned with the generic properties of prospective reimbursement. Clearly, prospective reimbursement can be implemented in many ways. These variations can modify the impact of prospective reimbursement. For example, facility based rates are likely to lead to facilities being at the ceiling more rapidly than group based rates, since the former system reduces the influence of any individual home. Nevertheless, such differences do not alter the previously mentioned central tendencies.

With the exception of this study, all empirical work on the impact of prospective reimbursement has involved the hospital sector. In general, the results are weak and suggest that prospective reimbursement in hospitals has little or no impact on costs (Cromwell, 1977, contains a useful summary of this research). These results are supported in the more sophisticated and extensive study by Sloan and Steinwald (1978). They conclude (p. 40) that,

> "Past research, on the whole, has failed to show that prospective reimbursement contains hospital costs. Our findings also suggest that prospective reimbursement has, at best, a very small effect on costs and input use. All we can say is that prospective reimbursement has not proven itself to be an effective inflation strategy, and current reliance on prospective reimbursement to hinder future hospital cost increases is unjustified."

Evidence from the empirical work of this study, discussed in Chapter 3, supports such conclusions for nursing homes, too. While the conventional wisdom has been that prospective reimbursement is "better" than a retrospective reimbursement system, the national cost analysis found that nursing homes under prospective reimbursement were more costly than under other (flat rate and retrospective) systems. That is, there is no evidence that prospective reimbursement is the "better" cost containing system.

Since prospective reimbursement currently is in vogue as a method for containing costs, some discussion of its apparent lack of leverage over costs is appropriate. That such prospective systems are commonly seen as inherently superior to retrospective systems may be due to the fact that setting prices prospectively is more in keeping with price setting procedures in private markets. However, in the context of the current nursing home environment, the apparent advantages of prospective reimbursement should be carefully scrutinized with respect to access and quality of care as well as cost impacts. That is, it appears from the results of the multi-equation model that a prospective reimbursement leads to improved quality of care and access, although not necessarily to reduced costs.

The uniqueness of a prospective rate system lies only in its timing aspect. Nothing else, aside from before-the-fact price determination is set. The entire gamut of possible reimbursement systems can be couched under the umbrella of prospective reimbursement. In explaining the varieties of prospective reimbursement, Sattler (1975) emphasizes that it is only through timing of the establishment of the rate that prospective reimbursement differs from other rate setting approaches. "A prospective rate can be based on various criteria and expressed as any one of a number of possible units (per diem, capitation, by admission, and so on." (Sattler, p. 29). The entire range of posible rate-setting approaches is possible, including bidding, negotation, budget review, and formula, as well as all their combinations. Techniques can include the use of inter- and intra-institutional comparisons, specified ceilings, estimated cost functions, variable increases that fluctuate with pre-set criteria such as the consumer price index, and normative flat rates.

Although prospective reimbursement systems are cost-related in principle such that reimbursement rates reflect average cost levels, these levels are constrained by ceilings or limitations on maximum levels of

reimbursement. A typical type of ceiling is that the reimbursement rate may not exceed 80 percent of the average costs of similar types of nursing homes. If, as usually the case, prospective reimbursement levels are keyed to the previous year's costs, then costs can be continuously inflated and actual operator costs still will rise to the level of the prospective ceiling. Note, however, that the base year for determining cost related ceilings need be neither directly a function of any given provider, nor the immediate year. If the base remains constant and not inflated every year, then it might be possible to maintain lower reimbursement rates. Politically, this alternative of maintaining a historical base over time with no inflationary adjustment may not be possible. The fundamental principle would be to have nursing home costs adjust to the rate, rather than letting the rate adjust to the costs. As will be discussed in Chapter 6, the use of a formula system for setting rates can go in the direction of making providers into rate takers rather than rate makers.

Consider what occurs when the maximum prospective rate is known in advance by the nursing home operators. No matter how the rate was derived, if it was based on cost related principles there is no incentive for the operator to not raise his price to the maximum allowable cost. So long as the home's costs are below the pre-set ceiling, the home can increase revenue by increasing the costs to the ceiling and suffer no penalties. Under a cost-related notion of prospective reimbursement, there is no reason for costs not to float up to the ceiling. While the different approaches do have varying degrees of impact at the margin, the central tendency for all--under conditions of excess demand where there is no need to cut price to fill beds and a zero patient price--is to allow costs to rise to the ceiling level over time.[1]

The empirical result found in Chapter 3 that nursing homes in states with prospective reimbursement had higher per diem costs than homes

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[1] One modification which has been suggested as an incentive to keep costs down is to share the excess between the maximum allowable prospective rate and the incurred cost with the nursing home. Yet, one can argue that it is still to the long-range advantage of the operator to raise his costs to the maximum allowable ceiling. In doing so, he is building a bigger base for future calculations of the prospective rate. Moreover, it is easy to conceive of situations in which the profits to be shared--in the year that operator costs are less than the maximum PR rate--can be hidden in the excess expenditures necessary to get costs up to the ceiling.

under cost-related or flat-rate reimbursement systems may be due to a variety of reasons. The result may be an artifact of unobservable but important differences in the reimbursement systems; the cost ceilings used in the states with retrospective systems in this data may be more cost containing--i.e., lower--than the rates set under prospective reimbursement. Or, the result may be due to problems of equation specification and errors in variables (e.g., omission of correct quality measures). Alternatively, it may be that higher costs are associated with prospective systems for political reasons. If rates are set in advance, then the nursing home operators are at risk to unforeseen events and may negotiate a higher rate to cover the risk. This situation is in contrast to retrospective cost-based systems wherein the home is for less risk, since he can pass on the "allowable" costs. An offsetting argument here, however, is that prospective systems are typically marketed to providers as a way to reduce their retrospective risk to unallowable costs. That is, because their rates are not fixed in advance, providers under retrospective reimbursement are uncertain as to what costs will and will not be allowed. Thus, it would appear that providers are at risk under both prospective and retrospective systems. Hence, another interpretation of the empirical results is that the risk premium paid under a prospective system is greater than that paid under a retrospective system. In general, while the empirical work found that prospective reimbursement systems were associated with higher costs, this result may be due to a confounding with other unmeasured variables. Thus, the costs of nursing home care in these states could have been very high in earlier years such that the prospective reimbursement was initiated as a cost-containing response. Under these circumstances, the higher prospective costs would be an historical artifact, and not the inevitable result of prospective reimbursement. The basic point appears to be that under conditions of excess demand and zero patient price, neither prospective nor retrospective systems have an inherently greater cost containing potential. Rather, the key element appears to be the process of setting the rate and the nature of the ceilings.

The choice between reimbursement systems is important for there are a range of objectives other than cost containment. The fact that a reimbursement system fails to meet one criterion does not mean that it should be abandoned given that it may perform well on other criteria. In short, given that the nursing home industry is experiencing excess demand and insofar as

reimbursement is based on cost, it may be unreasonable to expect that the manner in which reimbursement is undertaken will have a controlling effect on inflation. However, other aspects of nursing home care may be significantly effected. Prospective reimbursement systems do appear to result in improved quality (or at least increased services) and access for public patients. Furthermore, although prospective reimbursement was empirically associated with higher costs, a conservative statement is that neither reimbursement system is inherently superior with regard to its inherent cost containing potential. That prospective reimbursement appears better on access and quality criteria while not necessarily inherently worse on cost criteria implies that a prospective reimbursement system, indeed, may be a desirable way for nursing home reimbursement to proceed. In any event, the choice depends on the policy weights given to the achievement of access, quality of care, and cost containment. Furthermore, prospective reimbursement allows better planning on the part of the nursing home operators, for they know the constraints under which they will have to live; in essence, prospective reimbursement creates an environment where rational management decision making can take place.

5.2 Options for Determining Reasonable Costs

In the nursing home industry the cost containing aspects of any reimbursement system--under a cost-based system of setting rates where there is excess demand--is the level and manner in which the ceiling for the rate is set. Since there is no reward for having costs below the ceiling, homes will tend to raise costs to the ceiling level. To put the point alternatively, that reimbursement rates are in part under the control of nursing home operators and in part subject to maximum limitations established by the government results in price controls that try to set a price which assures the producer a reasonable, not maximum, profit. For a given set of policies[1] the administration of such a system basically involves the technical process of resolving differences of opinion between the rate setters and the producers about the meaning of "reasonableness."[2]

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[1] The policy issues of concern to the rate authority include access and quality of care, as well as cost containment. These goals clearly are interdependent. The point here is that, once these policy issues have been considered and appropriate decisions made, the rate authority then must consider the process and structure of rate setting and the commensurate ceilings.

[2] Wiles (1961) contains a more extensive discussion of these points.

5.2.1 How to Define Reasonable Expenditures

In practice, there are a variety of ways to establish reasonable levels of expenditures. While the specifics differ, they are similar in that rate setters are defining what types of cost variation are and are not acceptable.

The most basic approach defines the types and levels of expenditures that are "allowable" and "reasonable" (as under the Medicare system); for example, expenditures for privately cooked meals may be "unallowable." The reasonableness of the level of allowable expenditures can be determined by reference to the level of input prices in the relevant market area. Because such a procedure considers only the costs of the facility in question, it leaves the operator with a large degree of control over his rate.

An alternative method considers the costs of all facilities in a group (where the group is determined by non-cost characteristics such as size, ownership, or location). In this situation, the rate for a particular home is set by comparing its costs to those of other facilities in its group.

Two basic approaches exist for defining reasonable costs and setting rates under a grouping method. The first is a tabular analysis of the costs of homes in a particular group. This procedure is the most widespread mechanism for defining reasonable levels of expenditures. In its most rudimentary version, such an approach considers a single dimension of the nursing home (e.g., SNF homes are grouped separately from ICF homes). Cross tabular analyses of a limited number of variables also are possible (e.g., ownership by level of care). On the basis of these tabular analyses, the state may set the ceiling rate equal to some parameter of the cost distribution (e.g., the 80th percentile). Multivariate statistical analyses are an alternative to grouping along a limited number of dimensions. Such multivariate analyses can incorporate the effect of a large number of product and facility dimensions on costs.

5.2.1.1 Rates Set On the Basis of A Limited Number of Variables

Ceilings and rates set on the basis of a limited number of facility and product dimensions have a number of problems. They tend to: reinforce the status quo; bias management decisions; be based on ad hoc impressions of why costs vary; and emphasize equity as opposed to efficiency concerns.

While some of these problems also are present when using multivariate statistical analyses to set ceilings, the later procedure can mitigate the undesirable consequences of considering only a limited number of variables to set rates.

The first problem with a limited variable approach is that such methods reinforce the status quo with respect to cost and output provided; by considering the behavior of one facility with respect to a subset of facilities, the facility is not compared with homes in other groups which may be more efficient or of higher quality. Alternatively put, consideration of only a limited number of dimensions reinforces any differences between the groups.

Consider the use of ownership status. All the cost analyses conducted for this study found that non-profit homes had higher per diem operating costs than did for-profit homes. While quality measures were not available in most of the analyses, a measure of quality was available for the New York data. For-profit facilities in New York still had lower operating costs than non-profit facilities, after controlling for quality and many other variables reflecting differences in production. While some cost differences still could be due to unobserved variables, it is our best judgment that rate setters that differentiate on the basis of ownership are creating incentives for either inefficiency or increased production of amenities.

When rates for the group of non-profit homes are set without reference to the costs of for-profit facilities, there is less incentive for the higher-cost non-profit facilities to reduce their expenditures. Thus, Chapter 3 found that non-profit facilities were relatively less costly in Massachusetts where a single ceiling applies to profit and non-profit homes than they were in New York at a time when separate ceilings were applied. When New York began to apply a single ceiling for both types of facilities, the costs of non-profit homes declined.

Another problem with setting reimbursement rates in consequence of a limited number of variables is the resulting biases that occur from not considering the full range of variables that effect cost. One consequence is the omitted variables problem. While it may appear that costs vary with respect to a particular ceiling variable, this variable may be only a proxy

for an omitted variable that in fact is related to costs. Another consequence of focusing on a narrow set of variables is that rate setters are creating an arbitrary incentive for operators to overproduce along allowable dimensions and to underproduce along unrecognized dimensions which also may effect costs. A typical case here is the use of ceilings developed on the basis of services. Paying for service inputs, by definition, creates an incentive to over-provide the allowable services beyond what patients might choose or need; since inputs (rather than outputs) are paid for, they will be produced.[1] Such ceilings can constrain management decisions; providers will respond to style of production mandated by the ceilings, rather than substitute inputs in response to relative prices (unless input prices, too, are used in the grouping).

A third problem with rates set on the basis of a limited number of variables is their ad hoc nature. Typical ceilings currently in widespread use are often based on an incorrect impression about what causes variation in nursing home costs. Consider the use of groupings on the basis of bed size. The usual view is that there are economies and diseconomies of scale which should be taken into account in determining ceilings. But this implies that the more efficient sizes of facilities are held to a higher standard of efficiency and are not rewarded for having chosen a lower cost scale of production. Similarly, inefficient size homes are not penalized for their inefficiency.[2] Thus, scale ceilings support the status quo size distribution of facilities.[3]

A final problem with such ceilings is that they tend to emphasize equity rather than efficiency concerns. Consider the use of input prices. Allowing reimbursement rates to reflect the impact of input prices on costs allows an equitable distribution of homes in that access is maintained in both high and low input price areas. However, on efficiency grounds, use of

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[1] This overemphasis on inputs is especially troublesome in that inputs need not be related to quality.

[2] In fact, the national and state cost analyses reported in Chapter 3 found that the number of beds was not a statistically significant determinant of average operating costs. It would appear that using bed size as a grouping criterion is not only theoretically misconceived but empirically unimportant.

[3] Perhaps the best that can be said about such ceilings is that they may help meet equity concerns and support maintenance of overall continuity of care for patients in that they do not bring about the disruption that would occur when inefficient firms are driven out of business.

input prices is not justified. If input price variation were not allowed, homes in high cost areas might reorganize, perhaps by cutting back on the quality of their care so as to reduce their costs. Alternatively, the homes might turn to the private market and so reduce access for public patients. It is not that equity concerns are an improper basis for setting a reimbursement rate; indeed, equity concerns are important. Rather, the point is that by focusing on a narrow set of variables to set ceilings, rate setters are not recognizing the full range of variables that affect costs. Hence, they are not considering the comprehensive set of alternative production and policy tradeoffs.

While some of the outcomes discussed above are unavoidable consequences of a reimbursement system trying to meet multiple goals, proper use of multivariate cost analysis in the context of a formula set reimbursement rate can reduce some of the more undesirable consequences of limited dimensional grouping.

5.2.1.2 The Uses of Multivariate Cost Analysis for Reimbursement

The previous section argued that the discriminating variables typically used by the states to differentiate and group homes often lead to undesirable results. An improvement upon discretionary judgments about what leads to variation in operating costs is possible if rate setters conduct multivariate cost analyses similar to those presented in Chapter 3.

Several types of useful information are provided from cost analyses. First, rate setters can develop a reasonably accurate view of the determinants of historical nursing home costs. Thus, multivariate cost analysis techniques allow an alternative to grouping homes in terms of their facility characteristics and basing a reimbursement rate on a single parameter of the cost distribution of homes in the group. Multivariate cost analyses can be used to consider all homes together and evaluate how a broad range of characteristics effects variation in costs. Including nursing home characteristics relevant to what it is that the rate setting authority wishes produced means that the rate can be keyed to cost variations commensurate with desired output. In this way, the information from a cost analysis can yield a first approximation or screen to what a "proper" reimbursement rate might be.

The second type of information generated from cost analyses is the identification of high cost and low cost outliers. An agenda containing a list of nursing homes that should be examined more closely can be generated

in a fairly systematic fashion, by isolating those facilities which have large "residuals" in the cost analysis. High cost facilities may be inefficient, or they may be providing useful but unmeasured services or quality, or they may have quirks in their data or accounting procedures. In contrast, low cost facilities may be efficient, or they may be deficient with respect to quality or have data problems. Given a list of outlier homes, more detailed analyses on an individual basis of these possible reasons for outlier behavior is possible.

A cost analysis is relatively simple to perform and less time consuming than a detailed budget review of every nursing home. This windfall of information allows rate setters to come closer to determining the reasonableness of the reimbursement and nursing home budget situation. Nevertheless to use the cost analysis results without further investigations can only lead to administrative nightmares. The resulting cries of arbitrary rates and litigation in the State of Washington--which recently began to set rates on a formula basis on the basis of cost analyses--attests to these difficulties. Thus, it is important to consider what cost analyses can not do.

5.2.1.3 What Cost Analyses Can Not Do

For several reasons, cost analyses of historical cost data may not identify either efficient nursing homes, per se, or the costs of efficient provision of nursing home care. Indeed, these problems also are present when setting rates on the basis of a limited number of variables. While useful for evaluating the costs of homes in a relatively timely manner, cost functions should not be used per se to set a formula rate. First, the results of cost analyses reflect the determinants of historical cost, which need not reflect the costs of efficient operation. A variety of factors have led to the historical cost distribution. One of the basic conclusions of Chapter 3's discussion of the determinants of cost variation in the nation and in the states of New York, Massachusetts, and Indiana was that historical regulations and reimbursement practices were a key factor underlying the results. For example, the instability of the Massachusetts and New York occupancy results across the years suggested that changing regulations were at least as important as any unobserved economies of scale or utilization. That Massachusetts had few homes operating at less than 90 percent could be attributed to occupancy penalties rather than economies of scale. Similarly, when New York stopped treating non-profit and for-profit facilities differently, the differential in their costs dropped dramatically.

On a more methodological level, the properties of ordinary least squares (OLS) regression techniques used in cost analyses (as in Chapter 3) also imply that the resulting estimates do not reflect efficient production. By estimating a least squares cost curve, equal weight is given to minimizing the estimated residuals associated with all nursing homes. The average cost curve reflects the net result of considering both efficient and inefficient homes. Had the industry been in an "efficient" equilibrium position, then the average cost curve traced out by the statistical analyses would have reflected the envelope of minimum (efficient) costs. However, the observations of facility cost reflect the historical position, determined to a large extent by regulation, and--it is safe to say--not a long run "efficient" minimum average cost curve. The estimated cost impacts of particular variables reflect historical costs, not the use of efficient production.

Another property of ordinary least squares analysis--indeed, all statistical analyses--is that the results are very sensitive to both the data and the specific variables used in the analyses. If the raw data used in the statistical analyses contains errors, then the resulting estimates, too, will be in error. Similarly, the manner in which the variables are specified has a major effect on the resulting estimates of the determinants of cost variation. While good data "cleaning" and proper specification can result in approximations to the underlying "truths," some degree of error is inevitable. While the results do provide useful information, they must be used cautiously as, at most, meaningful approximations to underlying phenomena.

Chapter 6 discusses more extensively the uses of multivariate cost analyses in the context of screening/budget review rate setting procedures. However, a prior point to consider is the impact of regulation and reimbursement practices on standards of care.

5.3 Options for Maintaining Standards of Care: Regulation

Throughout this report, there has been an emphasis on the dynamic nature of the nursing home environment--that facility operators alter their behavior in response to the regulatory environment to further their objectives. The evidence from the multi-equation model of the nursing home industry in Chapter 4 was presented mainly to document this point. The cost analyses, however, were set in a static world to associate existing characteristics of the facilities with cost differentials. Yet these characteristics

in reality are not constant, but are determined in response to policy directives. If rates go down, it may be quality which is affected, in addition to facility costs. While the cost models described some of these effects on operating costs, the multi-equation model revealed that reimbursement and regulatory policy also affected service intensity, occupancy rates, public-private mix, and the private rate.

These tradeoffs must be considered by rate setters in designing their reimbursement system or there will be unforeseen consequences in terms of the standards of care maintained by facility operators. For example, if the rate is set very low, then many homes will find their rate less than their costs. While some production changes in the direction of increased efficiency may occur, the higher cost homes also are likely to cut back on the quality of their care so as to reduce costs. Access for public patients also may be reduced, as the high cost facilities turn to private-pay patients who pay higher prices.

Evidence from the empirical chapters illustrates these tradeoffs. Previously, it was argued that prospective reimbursement might result in higher operating costs and more generous rates to allow operators to cover the possible costs of unforeseen events. From the multi-equation model, it appears that nursing home operators under prospective reimbursement do have higher costs. Furthermore, they provide more services and nursing hours per patient-day. Indeed, it appears that prospective reimbursement also leads to a relatively higher public to private patient mix.[1] Apparently, under conditions of higher public rates, nursing homes find private patients relatively less desirable.

The converse of this result is notable, too. In states with relatively cost containing systems of reimbursement, access for public patients was reduced, while rates for private patients were higher. Under situations of lower public rates, nursing home operators apparently are more conservative in their willingness to provide services and care to public patients.

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[1] Cromwell (1976) found a similar tradeoff for hospitals operating under prospective reimbursement in New York: length of stay increased.

Other tradeoffs were found in the multi-equation model. Homes in states with absolute reimbursement ceilings had lower operating costs--but they compensated by providing fewer nursing hours per patient day and fewer services. Similarly, absolute staff requirements lead to reductions in services.

That a reimbursement scheme that might emerge from a cost modeling effort alone could entail unknown and unacceptable alternatives in output (as providers respond to the reimbursement rules) implies that the state must follow one of two courses with respect to regulation in order to maintain standards of care. One possibility is to design a reimbursement system which anticipates the future responses of nursing home operators. Alternatively, since regulations may be both excessive and ineffective[1] in achieving an output in line with public policy goals, it may be desirable to partially deregulate the industry.

5.3.1 More Regulation: Defining the Product

It was argued above that nursing home operator behavior responds to regulatory and reimbursement rules. One possible governmental response would be for rate setters to carefully define the product that they want produced and reimburse only for this product. In this way they would not have to anticipate operator behavior, but only determine that their pre-specified product was produced. Reimbursement rates would be designed to cover the costs for this well specified product. They would pay neither more nor less than those costs incurred by an efficient operator to produce the pre-specified product.[2] In this way, regulators could specify appropriate care for patients of different debility levels and pay operators on the basis of what was produced, provided that it met the policy goals as articulated in the standardized product definition. Nursing home operators would agree to

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[1] For example, from the multi-equation model, it appears that occupancy penalties may not effect occupancy rates, nor do absolute staff requirements necessarily lead to an increase in nursing hours per patient day. Note that the occupancy penalties results could be explained by any of four possibilities: 1) they had no effect whatsoever; 2) they were set so low as to be a non-binding constraint; 3) occupancy rates were maintained by increased length of stay or admissions; or 4) fewer beds were built.

[2] Such rates could be determined from a cost analysis or time and motion study of "best practice" homes providing the desired product.

provide the pre-specified care to public patients at a rate determined either prospectively or retrospectively.[1]

There are a number of pitfalls to this proposal. One is the difficulty of determining an "efficient" rate. As discussed previously, it is methodologically difficult to determine the costs of efficient production. This problem might be overcome by identifying and analyzing "best practice" homes which were producing the desired product. However, setting rates for all homes on the basis of "best practice" homes might lead to reductions in quality if the inefficient homes reduced their services in an attempt to bring their costs in line with the more efficient homes.

Another obstacle to such a system is the difficulty of defining the product of the nursing homes. The difficulty of defining the product in terms of output measures has been discussed earlier. While difficult, such measurement too appears possible. For example, Bicknell and Walsh (1976), have discussed the use of performance. In a more output-oriented vein, Jones (1976) has developed detailed procedures for patient evaluations. The costs of implementing such a system may be large; there is no evidence that such a system can be designed to operate at a reasonable level of administrative cost.

A final problem inherent to product definition, it is hypothesized here, is that it is politically undesirable. Technical problems of defining the product are surpassed by the difficulty of admitting that the state can afford to pay only very low rates. Severe constraints on the public fisc together with a general and pervasive ambivalence about providing high quality care to long-term care patients has meant that one of two events occur. Either public statements about what "should" be provided are never made (for fear that the public would react in outrage to such low quality yet fiscally sound care) or laudatory statements of desirable standards of care are made but are followed by spartan appropriations. Demanding a Cadillac but paying for a Volkswagen inevitably leads to provision of low quality of care. The problem of public product definition is not that the product

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[1] If the operators did not provide the agreed care, then appropriate penalties would be enacted. It would be important that the penalties not be mere reductions in the rate, for that would only serve as an incentive to reduce care. Instead, non-rate-related penalties could be used. For example, the operator might lose a "bond" that he posted in advance as a guarantee of quality care. Alternatively, the state might stop further placement of Medicaid patients in the facility.

cannot be defined. Rather, it is that it will not be defined at an adequate level and be followed by sufficient appropriations.

5.3.2 Deregulation

Every nursing home operator, rate setter, and regulator talked to during the course of this study felt that operators could circumvent, at some point, additional nursing home regulations. While foresight and anticipation are possible--and the results from the multi-equation work will be useful to such efforts--the evidence to date about regulation throughout the American economy supports such subjective, pessimistic opinions and underlines the severe difficulties if not the impossibility of correctly anticipating and compensating for all future regulatee behavior, although some reactions can be recognized and dealt with in advance.

For a variety of reasons--including capture of the agency by the regulatee, imperfect information, response to political pressure, and "wrong" decisions--regulated industries can be "characterized by higher prices, higher profits, and less output than would prevail without regulation" (Noll, 1976, p. 11.). The recent sharp decline of airline fares in response to the curtailment of airline fare regulation attests to the possible benefits of deregulation. Similar reductions in regulation also may be beneficial to the nursing home industry.[1]

An alternative form of quasi-deregulation is possible. It starts from the perspective that most homes are operating at reasonable levels of efficiency and quality. Under these circumstances, the rate setting authority needs to concentrate on the high cost and low quality "outlier" facilities. In this way the rate authority can maximize its leverage in the direction of achieving policy goals, while minimally interfering with the remainder of the industry. Chapter 6 considers these possibilities further.

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[1] Consider the following examples of nursing home regulations that do not lead to their desired results. The multi-equation model found that absolute nursing home requirements did not affect the number of nursing hours per patient-day, although they did lead to reductions in service provision. Prospective reimbursement (which its proponents claim will reduce costs) appears to lead to higher, not lower costs. Nor is it clear that greater input requirements for more services will result in better public patient care; in the multi-equation model greater service provision led to a higher private rate, a relatively higher private-to-public patient mix (i.e., reduced access), and higher costs.

5.4 Summary

The nursing home industry produces a non-homogenous product in which individual firms have at least some local market control. Under such conditions one of their most important economic decisions centers on the determination of price. Price is built up out of cost and the equilibrium between price and output is an administered one characterized by queues that are satisfying to both the operators and public regulators. Non-price competition prevails among these non-homogenous producers and makes it very difficult to relate price and quality. The existence of excess demand allows cost increases to be passed on rather than absorbed.

The choice then between reimbursement systems is not so much on the basis of their inflationary potential but rather on how well the reimbursement system performs on a variety of criteria. Although prospective reimbursement does not seem to perform as well as other reimbursement systems with regard to cost control, it leads to improvement with regard to quality and access considerations.

The problem for designing of a reimbursement system is how to place caps or ceilings on reimbursement in a manner which meets the equity, quality, access, and administrative ease goals of the government and still maintain control of cost levels. Many of the current methods of developing ceiling limitations are ad hoc which at best lead to unanticipated consequences, and at worst undesirable ones. A desirable direction for developing a reimbursement system is to use statistical cost equation estimates in conjunction with a screening procedure and careful consideration of the extent of necessary regulations.

Equity considerations are essential to reimbursement systems that are characterized by reimbursement of the reasonable costs of nursing homes. Strict efficiency considerations with regard to the operation of homes would concentrate on a single price with homes making adjustments to meet the price either by increasing productivity or leaving the industry. In contrast, the recognition of areal cost and other costs specific to the facility results in the subsidization of inefficient providers. In addition, equity concerns indirectly affect reimbursement systems insofar as statewide input standards are paid for through the reimbursement system. It is generally conceded that although universal standards may be considered equitable from some perspectives, they also undoubtedly raise cost and bias production functions toward inefficiency.

CHAPTER 6*

THE PROCESS OF OPERATING A PROTOTYPE NURSING HOME REIMBURSEMENT SYSTEM

6.0 Introduction

In brief, the previous chapters argued that the characteristics of a desirable reimbursement system for nursing home operating costs should include the following:

- it should be prospective in nature;
- it should be facility-based;
- it should screen individual facility costs;
- it should be administratively easy to operate; and
- it should make use of good data.

The prototype system outlined below has these characteristics. Furthermore it does so in the context of moving to varying degrees towards the achievement of the public policy goals--(1) access for public patients, (2) quality of care, (3) equity of treatment for nursing home facilities and patients, and (4) cost containment. The system is designed to achieve a limited and realistic set of objectives. Within the current nursing home environment no reimbursement system can be perfect and achieve an optimal result. Rather than design an "ideal" unrealistic system, the reimbursement system proposed here concentrates on the extreme situations. That is, it assumes that the majority of homes are operating at reasonable efficiency and that the rate agency should concentrate on "outliers"--the very high cost and very low quality homes. In this way, the rate agency can use its limited resources to maximize its leverage in efforts to achieve public policy goals. Once the most serious problems have been resolved in the initial years of operating the prototype reimbursement system, the rate agency then can proceed, if it wishes, with a more widespread review of the remainder of the homes. Note that the reimbursement system developed here for operating costs needs to be expanded to include reimbursement of non-operating costs, including issues of capital measurement, depreciation, and profit.[1]

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*by Howard Birnbaum, Christine Bishop, Gail Jensen, A. James Lee, and Douglas Wilson

[1]Only issues of operating costs were included in the scope of work of the study.

The system should be prospective--rates should be set in advance of the year they are to take effect--for reasons discussed previously. In brief, it was found that a prospective system increases the access of public patients as well as the quality of care and does so at minimal additional cost. Evidence to support the existence of such desirable effects was found in the multi-equation model. Homes in states under prospective reimbursement had relatively more public patients, provided more services, and supplied more nursing hours, ceteris paribus, and additional costs were on the order of 10 percent. Furthermore, prospective reimbursement allows better planning on the part of the nursing home operators, for they know the constraints under which they will have to operate; in essence, prospective reimbursement creates an environment where rational management decision making can take place.

For equity reasons, some might argue that the rate should be facility-based--i.e., based on the costs of the individual facility. This requirement need not mean that the rate equal the costs of a particular facility, nor that the costs in only the previous year be considered. Moreover, the prospective rate should be developed under a system of screens. Because facilities do have different costs, equity considerations imply that these differences be recognized. Furthermore, an approach which uses the facility as the unit of analysis as opposed to the patient is far simpler to administer. It is difficult to imagine how a patient-centered rate system could correctly and easily allocate costs on a patient basis, for such a system would require that every cost item be allocated on the basis of patient care so as to put a price tag on patients.[1] Finally, because some of these facility and patient differences can never be fully captured by the data (see Section 5.3), a rate developed strictly on the basis of a cost-equation formula will inevitably ignore some of the differences and create inequities; the result could be excessive litigation, as is currently the case in the State of Washington which is trying to use a formula system based

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[1] For example, since the labor of every nurse would have to be accounted for, there would be strong incentives to misrepresent actual time involvement. It should be noted that the system discussed below, while not patient centered, does take into account patient mix characteristics.

solely on a cost function analysis. In addition, a strict formula-based system creates incentives for homes to misrepresent patient, input, outcome, and cost data in a way that maximizes those ingredients which are more heavily weighted in the formula. The method discussed below substitutes cost screens based on a cost function analysis, with modifications made by the rate setting agency to set the rate. Such a procedure allows rate setters to maximize the policy effectiveness of the incentives.

By definition, the system should be relatively easy to implement in order to minimize the costs and time of agency administration. Such a system would place the burden of preparing budgets on the facilities as opposed to rate setters.[1] To improve the administrative efficiency of the rate agency, the system discussed below minimizes the need for retrospective adjustments and so allows rate setters to concentrate on setting the rate for next year rather than resolving problems of previous history. Finally, the rate setting authority would include both rate setters and facility inspectors under a single organization. Such an umbrella administration would integrate the information collection process and eliminate problems of coordinating facility input, output, and quality data with cost data.

A final desirable trait of the prototype reimbursement system is that it makes use of accurate data on relevant nursing home and patient characteristics. A reimbursement rate based on incomplete or inaccurate data means that the regulatory system is less efficient and less equitable. If the necessary data are accurate and fully utilized--the ingredients of a desirable data base are outlined in Section 6.2--,then the accuracy of the screen will be improved so that those homes having excessive costs or low quality can be identified and the rates can be set at the proper levels. Because the system requires accurate data, some states without such data will have to pursue major efforts to collect the requisite data. There is little possibility to improve upon existing nursing home reimbursement practices without improved data. Furthermore, use of accurate data adds legitimacy to the system.

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[1] It could be argued that many nursing home operators do not have the capability to prepare good budgets. The poor planning which will result from such a situation can only lead to inefficiencies. Hence, by forcing nursing homes to develop accurate budgets, the system will result in improved efficiency, although the cost savings will be offset somewhat by additional operator expenses for budget preparation.

6.1 The Process

The prototype reimbursement system discussed below involves the following nine steps:

- Set policy guidelines
- Develop screens to evaluate the reasonableness of nursing home costs
- Set preliminary rates
- Internal rate agency review of preliminary rates
- Inform nursing homes of preliminary rates
- Budget preparation by facilities
- Agency review of budgets to set final rates
- Retrospective adjustments
- Provider audits

6.1.1 Setting Policy Guidelines

The first step in setting the reimbursement rates involves the establishment of annual policy guidelines by the rate agency. Such guidelines would identify critical problems confronting the state's nursing home industry. The rate setting process then would focus on amelioration of these target areas. For example, the rate agency might decide to concentrate on improving the quality of care, providing improved access for rural patients, more hours of nursing, improved life and safety measures, or additional social services. Further, the guidelines would recognize the state budgetary situation (although they would not translate these budgetary concerns directly into flat rates of reimbursement). If the state anticipated extra funds, then the rate authority might decide to encourage additional costs for improving the level of quality. Similarly, the guidelines would establish acceptable inflation rates and other standards which are involved setting the rate. Once these policy guidelines have been established, they should be disseminated to the rate examiners for use in the screening and preliminary rate setting processes.[1]

6.1.2 Screening

The second step is to perform a cost function analysis, along the lines discussed in Chapter 3. The general procedure involves estimating

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[1] No doubt, the preparation of the initial set of guidelines will involve a substantial amount of activity. However, annual revisions should proceed reasonably smoothly.

a model of the determinants of nursing home operating costs. Of course, such estimation requires use of valid data; these issues are discussed below. The model should be fully specified in that it include all variables which belong in a technically proper specification. Section 6.2 discusses the technical process of establishing the screen and elaborates on what variables should be considered in the cost function analysis. Historical data from the selected base year on each of these variables for each nursing home which is to receive a Medicaid rate is used in estimating a cost function. Of course, the base year need not be the previous year. Using a base year(s) several years prior to the year for which the rate is being set tends to reduce automatic cost-inflationary tendencies.

The cost function takes the general form:

$$AOC_i = f(Q, P, R, F) \qquad (1)$$

where: AOC_i = average operating costs of facility

Q = vector of output produced by the facility

P = measures of input prices

R = regulatory variables

F = additional facility characteristics

The general result of the modeling process is a regression result portrayed as in equation (2):

$$AOC = a + b_1Q + b_2P + b_3R + b_4F \qquad (2)$$

where: a and b_1 represent estimated parameters of the equation

The results from the statistical cost analysis then can be used to establish screens for evaluating the reasonableness of the costs of any particular home. The predicted cost of a particular home is derived by multiplying each characteristic of the home by the estimated parameter and then summing the results. The predicted cost for a home then can be compared to its observed costs for the previous year. If the nursing home's residual term (i.e., its observed unit cost minus its predicted cost) is beyond some specified parameter of the distribution, say plus or minus one standard deviation of the predicted cost, the home is designated a first-stage "outlier."

The advantage of the estimated cost function approach is that it is relatively simple to use and less time consuming than a home by home review. In brief, a large amount of information is readily summarized. This windfall

of information can be used to evaluate the reasonableness of the home's costs and the reimbursement rate structure.[1]

It should be noted that the use of any ceiling factor like the standard deviation or some other parameter of this distribution (e.g., 10 percent of the mean average operating cost) or even an absolute amount (e.g., $5.00) is discretionary and is established during the guideline development process. The exact parameter depends on a variety of factors. A key factor is a determination as to the number of homes that examiners have time to carefully review. Use of two standard deviations as opposed to one standard deviation allows more homes to pass the first-stage screen and allows the examiner to concentrate on fewer facilities. If the state believes the data to be of poor quality, it may wish to allow broader latitude for variation. Further, the screen depends on the nature of the policy goals. For example, if cost containment is a priority, then it might use a low ceiling, i.e., screen out more high cost facilities.

The screens work to establish a corridor around the range of acceptable costs. Homes with costs which lie outside the corridor--either too high or too low--fail the first screen and are investigated in more detail as to why their costs are too high or too low.[2] This corridor can be represented as in equation (3):

$$E_i = C_i + (N \times S) \qquad (3)$$

where E_i = corridor limits for home i

C_i = predicted costs for home i on basis of its characteristics and results of cost analysis, i.e., $C_i = a_i + b_1Q + b_2P + b_3R + b_4F$

N = number of standard deviations allowed before a home falls outside the ceiling

S = magnitude of estimated standard deviation of the cost equation

If the corridor is large (N x S is large), then little attention is paid to outliers. But if the corridor is small, then more outliers are identified

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[1] However, because nursing home operators are unlikely to be familiar with such procedures and may question their operation, it will be important for the rate agency to conduct, at least in the initial year of the system, a series of workshops. These workshops would be designed to "demystify" the cost function approach.

[2] To reduce the work load of the agency, homes may be reviewed biennially or triennially.

for further study. Note also that the boundaries on the corridor need not be the same on both the top and bottom. If the rate agency desires to raise the quality of homes at the lower end of the quality range, but keep tight control over costs, then the policy guidelines could define the maximum limit of the corridor as one standard deviation, while allowing a two standard deviation range on the downside.[1] In this way, more high cost homes would be isolated by the screen than low cost (presumably low quality) homes.

It is important to realize that the description of the home as an outlier does not mean that the home is actually inefficient or providing low quality care. Rather, the designation of the home as an outlier is a signal to the rate examiner that given the best estimated model to date, the nursing home is worthy of additional examination in a second-stage of screening. That the costs of the home are in excess of the maximum corridor boundary could reflect high quality and expensive care rather than inefficiencies, or it could reflect problems in the home's data. Other explanations of course are possible as well. Similarly, the home could be screened out for having costs below the minimum corridor; this home might be either extraordinarily efficient or producing an inferior product, or--as always a possibility--be represented by poor data.

In other words, the cost equation results must be interpreted with other information on the home. Indeed, all homes, even those which pass the first stage screen must be evaluated with supplemental qualitative information available to the examiner in a qualitative second-stage screen, although homes "flunking" the first-stage screen and lying outside the corridor should be subject to closer scrutiny.

Such a concentration of effort increases the leverage of the rate agency and allows "more bang for the buck."[2] Information used in the second-stage screen to determine possible deficiencies in the care provided by some facilities includes data from facility inspectors about the structure of the home and the process and quality of care. In addition, the secondary

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[1] Here the maximum ceiling is E + 1 standard deviation, while the maximum is E - 2 standard deviations.

[2] Another way to increase the leverage of the rate agency is first to concentrate in the second stage screen on the largest homes in the state; the rates for these homes will affect the largest number of patients and have the largest aggregate cost impact.

screens should consider measures of provider productivity. These productivity screens should concentrate on the "big ticket" items including nursing, housekeeping, and dietary departments and perhaps maintenance and laundry departments as well. Examples of productivity measures include the ratio of patient-days relative to full time equivalent nurses, or the number of meals relative to the number of full time equivalent dietary staff. These productivity measures could be compared with similar measures for all homes in the state (e.g., a home's productivity index might be out of line if it were, for example, 10 percent over the mean) as well as the home's historical productivity trends (e.g., the home's productivity should be no less than in the previous year).

Second-stage screens also allow for incorporation of data about extraordinary circumstances (such as if the home's patients suffered a severe flu epidemic last year), or if the cost data on the home is subject to question, or if there are quirks in the accounting procedures of particular homes. In addition to allowing for qualitative relationships not captured by the cost data, the second-stage screening allows for incorporation of the policy guidelines. For example, if the rate agency wished to raise the quality of care provided to very debilitated patients, it might allow extra costs for such purposes or simply pay higher rates to homes near the bottom of the corridor as an incentive for them to provide higher quality.

To assist in the second-stage screening, the rate agency should maintain a statistical profile of each nursing home. Such a profile book would allow the examiners to determine quickly whether the home was undergoing extraordinary changes and whether it was providing problematic quality of care. It should include historical trend information on the structure of the facility and its age, changes in patient mix, occupancy, costs, and services, as well as quality of care information. These statistical profiles should be updated every year. Indeed, such a prototype system would operate best with a state-run nursing home management information system that can be periodically updated.

The outcome of the second-stage screen involves setting a preliminary rate for the home. After considering the available data on the home and considering the policy guidelines, the examiner may decide to raise (or lower) the predicted costs of the home in setting the preliminary rate. In brief, the screening process allows the rate examiner to readily evaluate the

costs of the homes and to focus on those few homes which do not pass the screens. Further, it allows incorporation of policy goals. Most homes can expect that their previous costs--subject to some marginal policy alterations and allowance for information on extraordinary circumstances--plus an inflation factor will be approved as the preliminary rate for the next year. The modifications allow for incorporation and emphasis of particular policy goals (e.g., access or quality) and qualitative data. In this way, the screening method is facility specific, allows for unique circumstances, and inserts "reality" considerations into an otherwise mechanistic process.

The screening procedure does identify a small set of homes both above and below the screens for detailed investigation. In this way the examiners can concentrate on a small set of high cost/low quality homes where the potential for cost savings and quality improvement is greatest. The implication is that past inefficiencies for the non-outliers will be allowed. While ultimately the rate setters may wish to eliminate all inefficiencies in the system, such efforts should occur gradually over time. Rather than create severe shocks throughout the entire industry, it would seem that a more reasonable procedure would be to concentrate initially on the extreme high cost and low quality homes.

Several additional points should be made. First, it is important that the screening procedure occur and the preliminary rate be set before the homes prepare their budgets. To allow the homes to set their budgets without presenting them with relatively stringent guidelines can only lead to unrealistic budgets and encourage "gaming" behavior. Without knowledge of what the rate agency feels is a reasonable budget, the homes might develop excessively large budgets in the belief that they would be negotiated down, but that the end result would be a rate set at a level higher than it otherwise would be if the original budget was more modest but realistic.

Second, the cost equation approach allows for equity across all homes in that an (ordinary least squares) regression gives equal weight to minimizing the estimated sum of squares of the residual terms associated with all nursing homes. The estimated cost curve predicts the average costs for each unit of output but does not give more or less weight to different homes. This multivariate procedure considers how a broad range of characteristics affects costs and is an alternative to grouping homes in terms of a single or limited number of their characteristics (e.g., size or ownership) and basing

a reimbursement ceiling on a single parameter of the cost distribution of homes in the group. Grouping procedures which focus on a limited number of dimensions--as argued in Chapter 5--perpetuate and magnify differences between the groups. For example, grouping homes on the basis of bed size implies that the more efficient sizes of facilities are held to a higher standard of efficiency while inefficient size homes are not penalized for their inefficiency.

A third point is that all homes in the state which supply care to Medicaid patients should be used in the cost function analysis. This universality is the only way to insure equity across all providers. While some states currently exclude homes with few Medicaid patients, such a procedure leads to a biased result. The argument to exclude predominantly private-pay homes involves an assumption that homes which concentrate on private patients produce a different type product. Yet such an assumption is not necessarily true. It was argued previously that it is the very nature of nursing home care that it is virtually impossible to measure the type of care delivered. Rather than arbitrarily exclude some small number of homes, it seems that a more appropriate strategy would be to conduct sensitivity analyses of the data to determine just how much the ceiling screen is altered by the use of a full set of homes. If necessary, these results then could be incorporated into the second-stage screening process. Such a process eliminates the possibility of allowing unknown biases to creep into the analysis.

The statement that all Medicaid provider nursing homes be included in the cost function analysis implies the absence of analysis of "best practice" homes. Advocates of a best practice home cost analysis argue that it is (1) possible to identify best practice homes which produce a product in line with public policy goals and (2) that the costs of best practice homes represent an efficient production process which should be enforced across all homes in the state. Neither argument is strictly accurate. The current lack of accurate quality-output measures for the nursing home product is well known, although Jones (1976) and others have begun to develop such procedures. Of course, subjective evaluations of best practice homes by facility inspectors are possible, but such subjective identification can lead to claims of capriciousness and arbitrariness. But even if such measures were used, it is not possible to translate cost estimates from these homes into a general rate structure and still maintain standards of high quality and access for public

patients. If ceilings on all homes were based on an analysis of only a small number of efficient homes, then the remainder of the homes would have to alter their production processes. While some steps towards improved efficiency would occur, no doubt some homes also would reduce their services and general level of quality in an effort to keep costs in line with the ceiling rate. Indeed, some homes might even leave the industry or reorient themselves towards the private pay patient market. In brief, if the rate authority cares about the quality and amount of public output, then it had best use the entire universe of Medicaid provider homes to establish the public rate. To illustrate the point, consider the following example. Homes in rural portions of the state are needed to provide access to rural patients. Yet because the population density in rural areas is low, such homes are apt to be small and so attract less than the highest caliber of administrators. Hence, they also are likely to be relatively inefficient. To set rates for such homes solely on the basis of efficiency concerns at minimum cost levels can only lead to a deterioration of quality, a reorientation towards private-pay patients, or a closed facility.

A fourth point is that it is desirable for the rate authority to calculate an accurate measure of inflation. Use of the gross national product deflator, the consumer price index, or other aggregate measures of inflation do not correctly account for cost inflation in the nursing home sector. The best alternative would be the construction of a separate nursing home cost index. Such an index could be designed to accurately reflect price changes for the types of goods and services purchased by nursing homes. Such an index would have to be weighted according to the quantities of different inputs used by nursing homes. These weights would change over time to reflect technological changes in the nursing home production process. The problem with using past rather than current measures of inflation could be remedied by using projected rates, such as used by the federal government in the President's budget message. The issue of retrospective adjustments for inflation is discussed later.

6.1.3 Consistency of the Preliminary Rates

The next step in setting the rate involves an internal agency "consistency review" of the preliminary rates. If there is a Commission, the consistency reviews could take the form of internal hearings between the examiner and members of the Commission; if there is no Commission, the reviews

could include the examiner together with the agency administrator or a member of his immediate staff. Prior to the hearing, the examiner would submit a rate package for the reviewer's study. The rate package would include the historical profile of the home, the results of the screening analyses, and other documentation used to justify the preliminary rate. This staff function requires coordination of information between the facility inspectors and the rate examiners. Hence, implicit in this prototype reimbursement system is an integrated regulatory and rate setting bureaucracy. Without such integration, it is impossible to coordinate the policy goals of quality of care with the rate setting process; agency separation virtually guarantees an inaccurate and delayed flow of quality information to the rate agency.[1]

In essence, the consistency review is a quality control check of the examiners to insure bureaucratic equity. Because each examiner will be responsible for setting the preliminary rate for only a relatively small number of homes, it is important to insure that what is happening to one home is also happening to all similar homes.

Consistency reviews also diffuse the rate setting procedure and eliminate the possibility that any single examiner will get co-opted (or paid off) by a single home or set of homes. It is important that each examiner review the same set of homes over time and that these homes be from a contiguous geographic area. This will allow the examiner to become thoroughly familiar over time with the unique circumstances of both the homes under his authority as well as the demographic and medical-social needs of the area. Yet it is also important to eliminate the possibility--through consistency reviews--that the examiner will become too closely involved with or sympathetic to some or all of his homes.

Finally, the internal review process allows for a final check with the policy guidelines. After the preliminary rates are established, the staff of the rate agency administrator should review the preliminary rates for consistency, accuracy, and aggregate policy appropriateness.

After the examiners have defended their proposed preliminary rates, supplementary analyses and necessary modifications are made. Once the "mark up" period is completed, the nursing homes are informed of their preliminary rate.

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[1]See Ruchlin (1977) for a cogent argument on the need for an integrated nursing home administration.

6.1.4 Budget Requests

Once the home is informed in writing of its preliminary rate as well as the policy guidelines, it must file a budget request with the rate agency. This budget request enumerates anticipated expenditures on a line item basis for each input--noting the number of units, the price of each unit, and the anticipated total cost. Further, the facility must specify its anticipated patient mix, in terms of relevant patient characteristics entered into the cost function analysis, e.g., age, sex, diagnosis, debility. To insure comparability across homes it is desirable that the budgets be prepared under a uniform chart of accounts or at minimum that the budgets follow uniform definition and reporting requirements. For example, all homes should report their expenses for contractual services in an identical manner.

If the home finds that its proposed budget is in line with the preliminary rate, then it need file only the budget request. If the facility finds that it cannot operate within the preliminary rate, then it may file a request for an exception along with its budget request. Since the preliminary rate was developed on a facility specific basis, it can be expected that most homes will file budgets in line with the preliminary rate. Further, since it is time consuming and costly to justify the need for exceptions, some homes will revise their budgets downward rather than initiate the exceptions process.

The exceptions process is also time consuming and costly to the rate agency. Thus, it is to its advantage, too, to present rates acceptable to the facility. To minimize the number of exceptions requests, the rate agency should present to all facilities a precise statement delimiting the nature of allowable exceptions and how they should be justified. Anticipated case mix and service changes are examples of possible grounds for justifiable exceptions. The preliminary rate was developed on the basis of the base year's case mix; if the home expects to serve a more debilitated (i.e., costly) patient mix or to produce more services, then the home would have to document how these changes will occur, how they will impact on its cost structure, and what new rate is believed appropriate. In brief, the home is allowed an opportunity to revise and alter its historical situation, but must document that the changes are not wishful thinking.

One possible way of reducing the burden on the rate agency which should <u>not</u> be implemented would involve sequential submission of facility

budgets. That is, all homes should submit their budget at the same time. While sequential submission (where different homes would submit their budgets at different points in time) would serve to smooth the flow of paperwork, it also would mean that the agency would have to continually revise its policy guidelines. Such revisions would mean that homes submitting later in the year would be subject to different standards; such evolving guidelines might lead to claims of unfairness and result in judiciary proceedings.

6.1.5 Budget Reviews

As soon as the rate authority has received the budget requests, it should perform an aggregate budget review. First, it should conduct edit, coding, and arithmetic checks in the form of desk audits to insure that all the required information has been supplied, is consistent, and has been entered correctly. Information omitted from the budget is obtained from the home and arithmetic errors are corrected. The second aggregate step involves repeating the cost analyses previously performed to establish the preliminary rate. This time, the cost analyses use the proposed future cost, facility, and patient data (where before it used actual historical data). The purpose of this review is to evaluate the potential aggregate consequences of the initial budget requests. In brief, the rate authority can preview what cost behavior can be expected over the next year--will the same facilities continue to be the outliers? Will the policy guidelines be met? What will be next year's aggregate program costs? In this way, the agency can anticipate future problems.

Once this aggregate budget review has occurred, the examiners should review the budgets of the individual homes. There should be two cycles to the individual budget reviews. Under the first cycle, budgets of all the homes are thoroughly scrutinized on a periodic basis, say every four years. Unless a nursing home is due for its periodic budget review, homes which accepted the preliminary rate by sending back a budget request in line with the examiner's proposed rate and which passed the first-stage screen would be involved in no further review. Under these circumstances, the preliminary rate becomes the prospective rate that the facility will receive irrespective of its incurred costs.

The second cycle of budget reviews involves annual scrutiny of two sets of homes. The first scenario involves homes which accept the proposed rate but which were outside the first-stage screen corridors. Because these

homes were ones which may have had excessive costs or produced at low levels of quality, their budgets should be scrutinized to look at the consequences of their new budgets. For example, it will be important to ascertain that the previously high cost homes did not reduce their anticipated cost by reducing standards of quality. The other annual budget review scenario involves those nursing homes which request an exception rather than accept the preliminary rate.

In requesting a different rate, the homes should follow precise guidelines in attempting to justify their request for an exception. It is not sufficient that they present a well-orchestrated set of complaints. Rather, they must specify the exact nature of their situation that was ignored by or not known to the examiner. For example, the home might discuss how it will be altering its patient mix from previous years so as to care for more debilitated patients in the upcoming year.

In the initial stage of requesting a revised rate, the nursing home operator presents his case to the examiner in an administrative hearing.[1]

Following this hearing, the examiner should evaluate promptly the exceptions request and come to a decision. The examiner then informs the facility of the result. If the exception is accepted, the nursing home is given its new rate. If the exception is not granted, then the home is informed about the reasons for denial. If the home still wishes to appeal, then there is a formal, full-fledged, item-by-item budget review[2] according to preestablished guidelines. The outcome of the formal budget review is a final prospective rate.

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[1] The hearing should occur under a spirit of cooperation rather than conflict. That is, the examiner should hear the operator's point of view and consider it carefully and vice versa. Neither operator nor examiner should assume a particular result; rather, the administrative hearing should involve an exchange of information in both directions. It may be that the nursing home operator has new information or can explain a previous event in a way not previously appreciated by the examiner. Similarly, the operator may not have understood the policy guidelines or the budget request procedures. In brief, the administrative hearing should be a "no fault" discussion of relevant facts in the context of the well-defined exceptions request made by the operator.

[2] A useful review of the problems encountered in budget reviews is in Hamilton et al. (1978 b).

6.1.6 Retrospective Adjustments

The intent of prospective reimbursement is to establish reimbursement rates in advance of the year that they are to apply. In this way, the nursing home is given a fixed rate; if costs are less than the prospectively set rate, the nursing home can keep the residual, while if costs exceed the rate, the nursing home bears the loss. In brief, the nursing home bears the risk of unanticipated future events and poor planning, but stands to gain extra profit if it correctly plans for the future. While some retrospective adjustments may be needed, they should be minimized. The more after-the-fact adjustments that are allowed, the closer the system comes to becoming a retrospective system. That is, the desirable properties of a prospective reimbursement system are subverted by excessive allowance for retrospective adjustments in that the incentives for proper management control are reduced. Prospective systems should force the operators to do their planning up front, before the year in question. If after-the-fact adjustments become common, operators would not take the planning, prospective budget preparation, and rate determination process seriously. Rather than view the prospective rate as a binding constraint on behavior, they might view it as only an approximation which allows for adjustments to correct for poor management.

Retrospective adjustments can be minimized by allowing adjustments only for changes in the regulatory and reimbursement rules, (i.e., when the government is at fault) and for acts of God, (e.g., flu epidemics). Adjustments need not be allowed for changes in planned patient mix or unanticipated changes in input prices or taxes. Adjustments for exceptional circumstances are desirable only when, in the opinion of the rate agency, the operator has incurred cost changes resulting from unavoidable circumstances beyond the operator's control. Since the operator has stated what his planned patient mix pool and service offerings will be, he should be forced to stay within these plans.[1] Rather than allow retrospective adjustments, a more efficacious procedure to allow for patient mix changes is to take these changes into account when determining the next year's rate. At that time, the home

[1] Indeed, one of the purposes of the screening procedures was to relate the rate to case mix, but to do so alongside other variables as well. If the rate is tied too closely to case mix, there is an incentive to misclassify patients. Allowing for retrospective adjustments for case mix opens this pandora's box.

can discuss the cost consequences of a more debilitated patient mix. Similarly, when the prospective rate was set, it took into account anticipated input price and tax changes. It is the nursing home's responsibility to plan for these changes for if it plans well enough, it can reap the financial rewards of the excess of rates over costs. Allowing such retrospective adjustments reduces the incentive for good planning and commensurate behavior. If in fact the home's costs do exceed the amount reimbursed under the prospective rate, then these additional costs are considered in setting the next year's rate.

Such an extreme view of retrospective adjustments clearly puts the nursing home operator at large risk. In contrast, retrospective cost-based rate setting places operators at significantly less risk. Ultimately the choice of where to be along the risk continuum is a decision that the state regulators will have to make in the context of fiscal prudence, equity, and political reality.

In summary, it is necessary to define closely those circumstances under which retrospective adjustments are permissable no matter what point along the risk continuum is selected. Without such explicit delineation, nursing homes will not know what is and is not permissable. Not only will operators take their planning less seriously in the mistaken belief that certain exceptions are possible, but further, they will perform unnecessary and unproductive paper work to seek an adjustment, and so increase their costs even further. From the rate setter's perspective, such avoidable paper work also will increase the costs and difficulty of administering the system. The examiners will have to spend time resolving situations which need not have occurred and will have less time to anticipate and plan in advance for the following year.

It should be pointed out that there is another avenue for requesting rate changes during the year for "controllable" situations that the operator may wish to respond to. Under certain well defined circumstances, the operator may propose a modification to the prospective rate. Such a modification may be necessary if, for example, a for-profit operator wishes to sell his home to a non-profit organization interested in expanding the provision of rehabilitative services. In this situation, the change in ownership may call for a revised budget and modification request. Here, it is not the rate that is changing, but rather the entire production agreement between the facility and the rate authority.

6.1.7 Provider Audits

Two types of audits are necessary under this prototype reimbursement system: (1) financial audits and (2) "real" audits.

Financial audits involve rigorous accounting audits of the homes' financial practices. They are designed to insure that the homes correctly represent their cost situations. Further, they are to prevent fraud and abuse. To insure an independent check, the financial audits might be performed by a group independent from the Medicaid rate setting agency.[1]

"Real" audits involve evaluations of the home's patient mix, service provision, and quality of care. For example, they should determine that the home's proposed patient mix was the patient mix actually served by the facility. Similarly, the real audits evaluate services and quality of care to insure their appropriateness to the patient mix. It is not envisioned that this real audit be a formal review on a patient by patient basis. Rather, they should be designed to generate an impression about the facility. The information from the real audit then is used in setting the next year's prospective rate.

Both types of audits are expensive and time consuming.[2] Moreover, some homes will need such "honesty provoking" audits more than other homes. For these reasons, the audits should occur on a sample of facilities. Every home should be audited only on a periodic basis, except for homes which were previously found in violation. That is, the sample of audited homes should be weighted to reflect previous violations similar to Internal Revenue Service procedures for auditing income tax reports.

6.2 The Technical Process of Calculating the Screen and the Reimbursement Rate

The key element of the prototype reimbursement system proposed here is the method for determining the screens, for it is the screens which identify outlier homes for further analysis. The point of the screens is to devise a system that allows rate setters to have the greatest possible

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[1] Since financial audits typically occur several years later than the year in question, this separation of agencies will not hamper the rate setting process. They never really are input into the rate setting procedure. Rather they are simply a check on the financial practices of the homes.

[2] Audits similar to those proposed here typically occur under current reimbursement systems, e.g., survey certification inspections.

leverage and to concentrate on homes with the most excessive costs or the poorest quality. If the screens are inappropriate, then the facilities they identify are inappropriate as well.

For the screens to work, two things must occur. First, the rate agency must have good, complete data on the full range of variables that affect cost. Second, the rate agency must derive the formula-type screens from the results of a technically correct set of cost equation results. These points are discussed below.

6.2.1 Data and Variables: The Key to the Cost Equation

6.2.1.1 Data Quality

If the data or the variables which enter the cost equation are unsatisfactory, then the resulting estimated cost equation parameters will be incorrect--e.g., variable X would not, in reality, have three times the cost impact of variable Y. In consequence, the screening procedures will inaccurately identify which homes should and should not pass the screens. Further the quality of the data affects the size of the confidence interval.[1] Data inaccuracies increase the confidence band around the statistical result--reduce the accuracy of a "point" estimate--and mean that the level of the screens, ceteris paribus, must be higher than if they were developed from accurate data. That is to say, higher screens translate into additional numbers of outlier homes which must be reviewed by the examiners; the result is that more effort is required in developing the preliminary rate. In addition, data inaccuracies may mean that the screening process incorrectly identifies homes; some inefficient homes or low quality homes may not be identified by the screens while some efficient or acceptable quality homes may be inadvertently identified as outliers. In brief, the screening procedures operate most effectively when the data are accurate, the data base is "clean," and the observations are from as recent a time period as possible.

6.2.1.2 Variable Specification

In addition to issues of data quality, there is the issue of what variables are represented in the data base and are specified in the cost analysis. The ability of the rate authority to screen homes is severely constrained if relevant information is not available. If the screens are to

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[1] See Johnson (1963) for a discussion of the effect of errors in variables on the degree of confidence of regression results.

check accurately for cost and efficiency concerns, then measures of the proper variables which technically determine cost variation must be included in the data base. Similarly, if the screens are to take into account patient mix and quality outcome, then suitable variables for capturing these effects must be included too.

The question of which variables belong in a technically correct cost function analysis is considered at length in Chapter 3 and in Technical Papers #4, #5, and #6. The paragraphs below summarize those discussions.

Rate setters need to know two types of information. First, what is the cost of using specified resources which are used in the process of providing nursing home care? This question is basically a bookkeeping question whose answer is derived from an analysis of the nursing home budgets. The second question is put to issue during the cost equation analysis: what is the cost of producing certain outputs or outcomes which are characteristic of the process of providing care? The formulation of the latter question is crucial in that it specifies those dimensions of output which will be relevant for the cost analysis.

The cost function of economic theory is a schedule relating the minimum costs of production to the output produced (Wallis, 1974). As output and input prices increase, so will costs. In addition, economies of scale and utilization are possible, such that there may be decreasing average costs as the output measure and the occupancy rate increase. Thus, the model should allow for the possibility of scale effects.

While ascertaining the existence of such effects is now a standard interest to cost function analysis, certain special attributes of the nursing home industry indicate a variety of additional concerns. First, the "output" or "product" of nursing homes cannot be meaningfully measured as a single quantity. Whereas patient-days of care is a useful indicator of the output level, it is only one of several output dimensions. In particular, the number of patient-days *per se* reflects neither variation in the "quality" of care nor in the "needs" of patients receiving care--e.g., it may be more expensive, *ceteris paribus*, to care for a non-ambulatory patient than for an ambulatory patient. Thus, the level of output in the nursing home cost function is more correctly a vector of home characteristics, including the number of patient-days but also including patient, service, and quality characteristics.

Second, the nursing home industry is regulated. In an unregulated industry, facility type would not be an explanatory variable since relevant output differences would be reflected in the patient and service characteristics. However, as a consequence of grouping by facility type during rate setting, historical cost differences may be maintained over time, independent of patient quality of care, and so forth. Furthermore, regulations may impose cost differences because of differential resource requirements, for example, by imposing staffing requirements beyond those "necessary" to serve the actual patient mix. Therefore, it is appropriate to take explicit account of regulation and reimbursement practices.

A third, more general point is the following. Alternative techniques are available to nursing home operators for producing essentially the same output and may reflect, for example, differential opportunities for operating on the general cost curve facing all nursing homes. This can imply cost differences related to facility characteristics (e.g., age of facility) or other differences in the operation of the facility (e.g., percent of services contracted).

In summary, average operating cost is a function of output, input prices, regulation, and additional facility characteristics. A general cost function model can be portrayed as follows:

$$AOC = f(Q, P, R, F)$$

where: AOC is average per diem operating costs

Q = vector of output produced by the facility, including:

- measures of scale of production, including:
  - average daily census
  - occupancy rate
- services
  - offered services
  - intensity of service use
  - presence of one-, two-, and three-bed rooms
- patient mix
  - age
  - sex
  - debility measures
  - health status (i.e., diagnosis at time of survey)

- case flow
  - admissions per patient-day (or length of stay)
  - percent death
- quality measures
  - survey certification ratings
  - other measures of quality

P = input prices
- wage levels
- SMSA location

R = regulatory variables, including:
- certification (i.e., SNF versus ICF)
- payment source (i.e., percent Medicare and Medicaid)

F = additional facility characteristics describing production differences
- ownership (i.e., profit/non-profit)
- chain ownership
- bed changes
- age of facility
- extent of contracting

These potential cost factors are discussed below.

Input Prices

Where the prices of inputs are lower, all else equal, total operating cost will be lower, inasmuch as operating cost is the sum of the products of the prices paid for inputs multiplied by the quantities of inputs. Furthermore, providers will use different, less expensive input mixes in response to different relative prices. The cost analyses conducted for this study found that input prices were positively related to costs. As discussed previously, it is important to use an input price measure exogenous to the control of the facility, e.g., area-wide measures of the wages of service employees. Even measures of the average nursing wage in the country are inappropriate for the aggregate combination of all homes in the country influence the local average nursing wage.

Scale of Production

A second type of variable that has been emphasized in previous studies (e.g., Skinner and Yett, 1973) is scale of production. The reasoning here is that firms which produce more output per unit time may be expected to

have lower costs per unit of output, due to their ability to spread certain "lumpy" costs over more units, and due to other factors which produce economies of scale, like discounts for large input purchases or increased specialization by employees. On the other hand, a very large rate of output may lead to higher average cost, if large organizations incur expenses for communication and general management that small producers do not face. If there are decreasing average costs (i.e., economies of scale) over some low range for the rate of output and increasing average costs over some higher range, a minimum cost rate of output can be found.

The rate of output can be broken down into two parts: capacity to produce output, and the rate of utilization of capacity. Of course, the provider can produce no more output than his maximum capacity for a given time period. Average cost may decrease with increased utilization as operating costs associated with capacity (e.g., staffing, utilities, and administration cost for a facility of a given size) are spread over more and more units. Also, average cost may rise as limits to capacity are approached, since it may become costly to manage and run a very full facility where staff and equipment are used as intensively as possible. Utilization (measured in terms of occupancy rates) thus may be separated from capacity, (measured in terms of average daily census or number of beds). In economic terms, it may be hypothesized that the size and occupancy rate of a facility affects its costs, such that there are both economies of scale and utilization. While such economies and diseconomies may be present, the analyses performed for this study found little evidence that such effects were present in an analysis of operating cost data for the nation, New York, Massachusetts, and Indiana. Of course, such effects may be present in other data bases, and every rate setter should investigate this possibility. They also may be found in an analysis of total costs, since facility, plant and capital considerations are major factors also leading to economies and diseconomies of scale. Proper tests of the presence of economies of scale are discussed in Technical Paper #3.

Output Descriptors

It is important to recognize that patient-days are not homogeneous. We have argued elsewhere (Technical Papers #1 and #4) for viewing services provided as a major dimension of nursing home output and that patient descriptors (e.g., age) are not so important in themselves, but

rather should be used in conjunction with information on the service intensity to assess whether or not the care provided is adequate--i.e., of appropriate quality. Costs thus vary directly with patient debility and other patient characteristics only insofar as facilities attempt to attain a similar level of quality. While direct measures of quality were not available for our analyses, if rate setters are concerned with quality of care, then suitable measures of quality must be developed for it is important to realize that more services need not imply more quality. In brief, it is critical to include proper measures of patient mix, services, and quality of output. Omission of data on one or more of these variables may result in inaccurate screens.

It is useful to elaborate briefly on measures of patient mix; the issue of service variables was discussed at length in the Technical Papers and we have little to contribute on proper measurement of quality of output except to emphasize the dearth of research on this topic and the importance of developing suitable measures.

For the purposes of cost analyses, the patient mix index used should first, relate to the overall patient mix of debilities in each home; second, capture the cost related aspects of the debility mix; and third, eliminate the problems found in the earlier attempts of researchers to aggregate the spectrum of patient's debilities into a useful index. With respect to relating to overall patient mix, the index should be designed so that it reflects both the range of patient disabilities the nursing home must deal with and the percentages or intensitives of various disabilities present in the home.[1]

After deciding what it is we want to measure, the second question becomes: how will debility be measured? To a large degree, the debility associated with a particular patient's case can be represented by the extent to which various activities of daily living (ADLs) are constrained. The level of ambulation, bowel and bladder continence and control, speech,

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[1] To rephrase these points, the types of indices developed have the problems of first, not utilizing all information pertaining to the range and the composition of patient debilities; second, not acknowledging the fact that different levels of various disabilities have different amounts of nursing care (hence costs) associated with them; and third, relating to the debility level of particular patients rather than to a group of patients.

vision, hearing, mental status, feeding ability, muscular strength and coordination, ability to dress one's self, and bathing ability are typically accounted for in some way when constructing the patient's debility index. There are differences in the literature with respect to which ADLs are used in the construction of an index, the method used to represent information on a patient's performance in each ADL, and the technique used to aggregate the data on a patient's performance in each ADL. Rather than digress further about these technical issues, the interested reader is referred to Technical Paper #3 for a complete discussion of alternative measures.

In addition to measures of ADL, other patient characteristics (including age, sex, and diagnoses descriptors) should be considered. Again, the interested reader is referred to the Technical Papers for detailed discussions of these issues. In our analyses, all of these measures of patient mix contributed little to explaining cost variation. However, it was emphasized that this lack of association could be due to data problems. The importance of accurate and complete data cannot be overemphasized.

Facility Characteristics

Facility characteristics can be seen as indicating a facility's ability to operate at the lowest possible cost given its input prices, capacity, utilization and type of output. Facility characteristics reflect alternative methods for producing comparable output and may reflect, for example, managerial decisions and abilities. Ownership status--for-profit, non-profit, or government--might, for example, be one of these. It is sometimes argued that non-profit homes are less cost conscious. This variable has also been widely used by regulators as an indicator that facilities are different for rate-setting purposes. One implication might be that rate setters believe the production process to differ by ownership. Similarly providers who are part of a nursing home chain may be able to provide care more inexpensively due to economies of joint purchasing and shared management.

Regulatory Variables

Regulations may affect differentially the nursing homes within a state. Homes licensed as SNF providers must meet certain criteria that are different than those that ICF providers must meet. Meeting these criteria may involve differential costs. The proportion of patients who are Medicare

or Medicaid beneficiaries may also be important; homes with a greater proportion of public patients may be relatively more constrained by staffing and other input standards than homes with few public patients.

6.2.2 Calculation of the Rate

Given that a rate agency has estimated a fully specified and technically correct cost function using all Medicaid nursing homes in the state with good data for each variable and each home, the next issue to discuss is the technique for calculating the reimbursement rate.

A naive approach would be to use the cost function itself and set rates. For example, if predicted costs for a facility for 1978 were $20.00, this amount times an inflation factor would be the maximum rate for 1979. While such a method may be expected to control per unit costs of nursing home services, this approach has a major drawback. It does not allow exertion of policy leverage through the rate to achieve policy goals tied to facility characteristics.

Rather than use the cost function coefficients to derive formula rates, the rate setting agency should select those product attributes that it wishes to pay for. While the cost function coefficients provide a base of information about the cost impacts of the variables, the agency need not recognize in the level of the rate the costs of all of these variables. Further, it may wish to allow for costs not found in the cost analysis. That is to say, the cost equation coefficients can be modified to provide active incentives and disincentives for providers to alter various characteristics of their facility in the pursuit of public goals.

Consider the patient mix variables. An operator could be encouraged to care for more debilitated patients by setting a rate that more than covers the predicted costs of this care. The case mix portion of the rate would be set at $\$(b_1 + a_1) X_1$ where b_1 is the predicted cost coefficient of patient debility variable X_1 and a_1 is the incentive factor, which will add to home revenue and allow the operator to take more debilitated patients. Similar incentives could be paid in addition to predicted cost for: taking more public patients from hospitals, which would increase access; providing higher service intensity given the patient mix, which would work to increase quality; or lowering the number of violations found by inspectors, which would work to increase quality.

Some variables found to effect cost differentials may not enter the rate, at all. The for-profit-non-profit distinction is a useful example of a cost-related factor that the rate agency should not allow. In all the cost analyses performed for this study, non-profit homes consistently had average costs in excess of those of for-profit homes. These higher costs occurred after holding all other dimensions of the nursing home constant, including services and patient mix. While most of the analyses did not control explicitly for quality (except insofar as inputs reflect quality), this result also was found in the New York analysis which did hold constant a crude measure of quality. Further, the multi-equation model found that, ceteris paribus, for-profit and non-profit homes produced the same level of services. In brief, the study found no evidence that non-profit homes produce a "better" product. Nor is it clear that even if non-profit homes in fact did produce a "better" product, that these homes should be treated any differently than the for-profit homes. If the agency wishes increased quality to be provided, then on equity grounds all homes should be treated the same. In sum, we would argue that the cost equation coefficient on ownership not be recognized in the rate.

While the agency ultimately may wish to set the rate allowance for ownership to zero (i.e., set the regression coefficient on ownership to zero), to do so without prior warning would create severe problems for high cost non-profit facilities. The alternative is to gradually reduce their cost differentials by reducing over time the rate allowance for ownership. In the first year the incentive factor might be set at 0.75 b_2 (where b_2 is the coefficient on ownership), with subsequent reductions to 0.50 b_2, 0.25 b_2, and 0.0 b_2 in future years. Such a gradual process would serve notice to the non-profit homes to alter their production process while allowing them sufficient time to do so.

Another related variable which might affect costs in a technical sense but which should not enter the rate is chain ownership. While our cost analyses did not find that chain ownership reduced costs (except in Massachusetts, for chains over 13 facilities), such an effect may be present in data for other states. However, if the coefficient on chain facilities does reduce costs and is used for setting the rate, then the agency is interferring in the management's decision about how to design an efficient production process. That is, by recognizing the lower costs of chain facilities in the

rate, the agency is creating an incentive for non-efficient production. Instead, the agency should not penalize chains for making efficiency-type organizational changes.

The nature of how the cost impacts of regulations enter the rate should be considered very carefully. In general the purpose of regulations is to alter provider behavior to achieve public goals. The point here is that some regulations are more or less effective at achieving this desired result. From the results of the multi-equation model, it appeared that regulations which constrained the management production decisions of the operators led to higher costs and a less desirable outcome than did regulations which were incorporated in the reimbursement system. For example, minimum staff requirements led to higher costs, reduced service provision and reduced access of public patients. Similarly, Certificate of Need laws led to reduced access and higher costs. In contrast, occupancy penalties--which were included in the reimbursement mechanism--led to greater services, increased access, and were less costly than staff or CON requirements.

The implications of the previous paragraph for setting the rate must be considered. In principle, the rate should not include the costs of meeting regulations which are not efficacious in meeting public policy goals. Indeed, such regulations should be eliminated and replaced by regulations which can be directly incorporated in the reimbursement scheme. On the other hand, states currently do have a variety of undesirable regulations and they do lead to costs which must be met by the revenue of the facility. In practice then, the rate must allow for such costs. For purposes of designing a prototype reimbursement system, we suggest that the state carefully evaluate its broader regulatory framework and move to eliminate regulations which constrain production decisions, and to replace them with reimbursement incentives in the screen itself.

Consider the use of occupancy penalties. The single equation cost analyses (reported in Chapter 3) found that there were neither economies nor diseconomies of utilization with respect to operating costs. Hence, there appeared to be no cost impact to greater levels of occupancy on operating costs. In the states considered there, including the cost of different levels of occupancy would not affect the level of the reimbursement rate. Yet it is desirable for reasons of access and service provision (from the results of the multi-equation model) to include an incentive for a higher

occupancy. This could be done as follows. Assume the rate agency sets an occupancy floor of 95 percent. The cost screen for homes which had an occupancy rate in excess of 95 percent would be unaffected. However, homes with an occupancy rate below the floor would have their per diem rate calculated as the ratio of total expenses to the number of patient days which would have resulted had the facility been operating at 95 percent capacity. For example, assume the fully specified cost equation calculation led to an average predicted per diem cost of $20.00 and that occupancy in a particular facility was at 90 percent. In this case the cost screen for that facility would be set at $20.00 x (90/95) = $18.95. By lowering the screen for such facilities the screen would catch facilities with lower-than-desired occupancy rates.

6.2.3 Use of Fully Specified Cost Equation

A final point about developing the screen should be discussed. The variables which are entered into the cost equation should include the full set of variables which the rate agency believes enter into a technical determination of costs. The estimated regression results undoubtedly will include a set of statistically significant variables as well as some variables which do not appear as statistically significant. It is important that the estimated coefficients on all variables be used to calculate predicted average costs, whether or not they are statistically significant. This should be done for political as well as equity reasons.

The purpose of the cost equation is to develop a forecasting tool to develop the best possible estimate of predicted average per diem cost. In this vein, the accuracy of an individual coefficient is not so important. Rather, the interest is in maximizing the accuracy of the prediction for the entire equation. While on statistical grounds, it could be argued that one or another coefficient is not statistically different from zero and should be excluded, the process of manipulating the variables until all coefficients become significant is itself very subjective. For example, assume there are two insignificant variables in the cost equation. The order of removing them could alter the results; if the first is removed the second might become significant, and vice versa.

The question becomes: which variable should be included? The answer must be made on merits of whether a variable is theoretically appropriate for inclusion, not on statistical appearances. It may well be that

the statistical result was due to the poor quality of the data. Trying to develop the proper specification on statistical grounds means that the process will degenerate into a very time consuming technical exercise. Nor is it clear that the ultimate results will change. For example, the cost analyses of the national as well as the state-specific data bases estimated both a fully inclusive equation (including all variables which belonged on technical grounds, both statistically significant and insignificant variables), as well as a limited equation which included only variables with a coefficient greater than the standard error (i.e., a t statistic greater than one). Aside from omitting a large number of variables, little else in the limited equation changed. See Technical Paper #4. Statistical analysis is part art and part science. The point is that if the rate setters firmly believe their cost equation is correctly specified, then they should go ahead and use the results that it generates.

If the rate setter begins to "tinker" with the cost equation to improve its statistical face validity he will also begin to violate its political viability. One of the desirable properties of a cost equation is that it can readily encapsulate the effect of a large number of variables; the national analysis performed for this study included almost 100 variables. In this way, the rate setter can allow for as many variables as he feels is technically appropriate. For reasons of equity, all variables which can possibly affect costs should be included. Facility operators also have a view as to what causes cost variation. To the extent that all of these variables are included in the cost equation and taken into account in setting the screen, then the operator cannot claim that the screen was set in an arbitrary manner.

In brief, it is important that the screening process create an environment in which the operators feel that they have been given a thorough and equitable treatment. The results of statistical analyses will never be accepted if they do not have face validity on theoretical and intuitive ground. Hence, it is best to include in the screen all variables from the cost analysis. It is only by creating an atmosphere of trust in which the operators feel that their special cases are being considered--which cannot be achieved by arbitrarily excluding variables for statistical reasons--that the prototype system will be administratively feasible. If the screens operate in a straightforward and simple manner, then the operators are more likely to accept the results and feel they are being treated equitably.

6.3 Implementation

To review the prototype reimbursement system outlined here, it was argued that: (1) the prospective reimbursement rate should be set on a facility-specific basis; (2) that it should be based on the predicted costs of the facility subject to marginal adjustments for reasons of inefficiency, quality, access, and equity; (3) that the rate should be based on a fully specified cost equation; and (4) that the rate should reflect the policy goals of the rate setter such that the state is paying for those output and facility characteristics that it feels are desirable.

It should be obvious that no state should directly incorporate any of the cost equations developed by this study for setting rates for its homes. Each state must carefully develop its own cost equations and screens, for one of the major conclusions of Chapter 3 was that the results of state-specific cost equations differ dramatically. Moreover the policy goals of the states as well as the characteristics of their facilities and patients will differ as well.

Implementation of the prototype reimbursement system will involve many preparatory activities. This report has emphasized throughout the importance of good and complete data. Any rate agency interested in implementing the prototype reimbursement system should do so only after it has developed suitable procedures and forms for proper data collection. Further, the rate agency should develop its cost analysis methodology and variable specification well in advance of implementing the prototype system. In addition, it will need to train its examiners and educate its nursing home operators in the procedures that will be followed under the new reimbursement system. Also, the system outlined here needs to be elaborated upon such that every procedure to be followed is precisely specified. Finally, the reimbursement system needs to take into account the uniqueness of its nursing home environment; the initial establishment of the policy guidelines serves this purpose. In brief, the start-up activities will involve significant expenditures of resources and be a time consuming process. At minimum one or two years of preparation would appear to be necessary before initiating the implementation of this prototype reimbursement system.

In addition to these activities, the state rate setting agency will have to develop an approach to reimbursing capital costs and profit allowances, and will need to integrate the approach with the prototype operating cost reimbursement system discussed above.

In ending this discussion Figure 6-1 presents a time line that describes how the prototype system might operate after the start up phase has been completed. It is meant to illustrate the magnitudes of calendar time that might be involved in operating the prototype system. The times needed to perform each of the steps obviously depend on the number of examiners in the rate agency as well as the number of homes in the states. However, given an appropriate number of examiners, it appears that the process of actually setting the rate could occur over a seven month period.[1] This schedule would allow the rate agency to have five months to prepare for the next round of rate setting activities or to perform other tasks. In other words, the rate setting procedure need start only seven months prior to the year it is to take effect. Of course, prior to the initial year of operation, significantly more planning would be needed for start-up activities and data base development.

6.4 Is the Proposed Reimbursement Mechanism "Reasonable Cost Based"?

Section 249 of Public Law 92-603 mandated that state Medicaid plans shall provide for payment of skilled and intermediate care facilities on a "reasonable cost-related basis," require uniform cost reports from providers and conduct on-site audits of the financial records of all providers. The latter two requirements are clearly appropriate for implementing the reimbursement system proposed above. The logic of how the provision of financial incentives to meet policy goals meets the requirement that payment be made on a reasonable cost-related basis is developed below.

The provision of incentives to encourage desired behavior implies that the reimbursement system may not pay the full cost of nursing home services provided but rather may pay more or less than that cost. For example, where care of certain types is chronically undersupplied, it may be advisable for the public program to pay more than the cost. In other cases, aspects of production which increase costs may not be considered of value to public patients, and thus should not be paid for. In this context it is helpful to remember the Marshallian distinction between supply (the marginal

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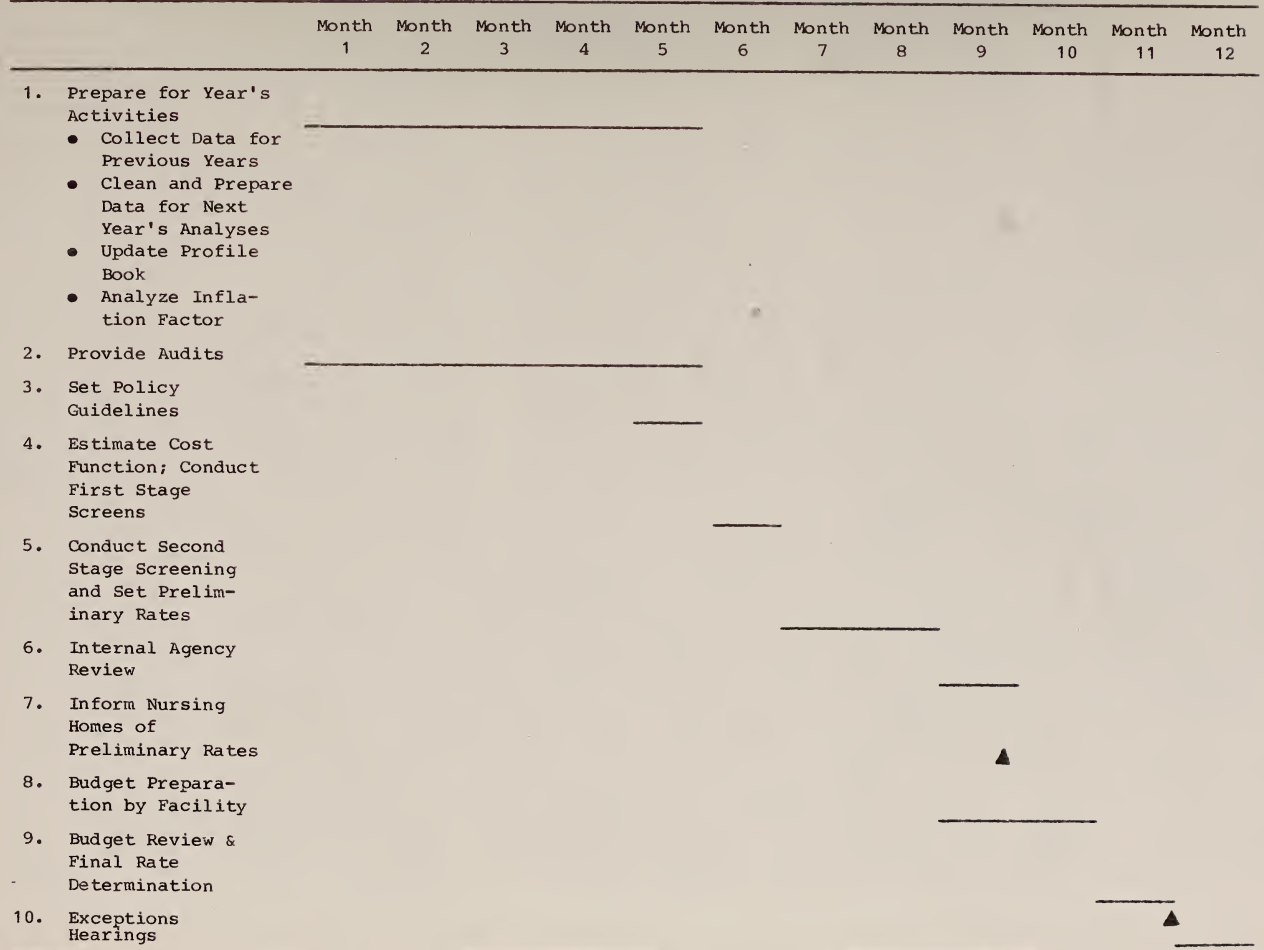
[1] This estimate was based on discussions with a number of rate setters as well as policy analysts at Abt Associates who are currently in the process of studying rate setting procedures for hospitals in nine states.

Figure 6-1

Timeline For Operation of Prototype Reimbursement System



cost curve) and demand (aggregate willingness to pay). In the economy at large, it is demand, not simply cost or supply that determines price; and certainly average cost is not a reasonable base for pricing in most markets. In this case, it is the demand for public care that is the critical focus.

For care types that are currently undersupplied, we propose incentives in excess of incremental costs, to make production of this care more profitable to providers. This signals a strong public demand for such care.

On the other hand, the government may legitimately choose not to pay the differential cost of some product differences that are not deemed of value to public patients, and thus express its lack of demand for such product attributes. As an example, it may be found empirically that care of a given service intensity for a given case mix is more costly in a non-profit than in a proprietary setting. It might be determined as a public policy that non-profit care, even with other factors held constant, was really a different and more valuable product from proprietary care, so a premium should be paid for it; however, all else constant, it might also be determined that equivalent care should be paid for in both settings at the same price. In this case, higher costs of the non-profit facility are not relevant to price determination, just as the price one is willing to pay for otherwise equal apples or automobiles does not depend on how far away they come from or whether the workers who produced them were Ph.Ds or elementary school graduates: factors which affect costs of production do not necessarily affect product attributes.

Such a system, while not reimbursing the cost of care, is nevertheless based on the cost of providing care that meets public specifications and thus meets the requirements of the law. In addition, the legislative history behind Public Law 92-603 clearly allows the states to have flexibility in setting reasonable cost-related payment rates to take into account desired incentives. For example, the preamble to the regulations (Federal Register Vol. 41, No. 128, July 1, 1976, p. 273030) reads:

> "The legislative history of Section 249 makes clear that the states are to be allowed great freedom both to define allowable cost items and to set a value on the reasonable cost of such items, and, in addition, states are to be free in setting their reasonable cost-related payment rate to take into account, on the one hand incentives toward efficiency and economy, and on the other hand, incentives to upgrade the quality of care and to provide for growth and improvements."

Given then that the state can define the product that it wishes to purchase, how is it to calculate the reasonable cost-related payment for that product? Does the method proposed above of basing reimbursement rates on cost functions also meet the cost-based criterion? It should be recognized that the answer to this question might be different for attributes of care that have been provided in the past and are included in the cost functions, and for attributes which policymakers wish to purchase but do not have cost data for.

For the care types produced in the past, the answer is clear: the determination of what expense categories are reasonable is left to the states, and these can be attached to industry-wide historical data to determine reasonableness screens. Interpretation of the regulations published by the Health Care Financing Administration (1977, p. 25) specify that "it is possible to develop a reasonable cost-related payment method under which the level of costs recognized as reasonable would vary depending on industry-wide cost experience. For example, the state plan might set ceilings on costs recognized as reasonable based on the mean plus one standard deviation of industry-wide costs." Thus, for historically produced products, rates need only be linked to industry-wide past performance. The only constraint in the preamble of the regulations (p. 27302) is that "the state must set a payment rate that it finds adequate to reimburse such reasonable cost, and could not set the rate so low that it clearly would not reimburse such reasonable costs. In other words, the state may not set the payment rate at, for example, 60 percent of reasonable costs." Furthermore, "once the state has determined what costs are reasonable it must pay 100% of such reasonable costs, and may not pay 60% of such reasonable costs. Thus, if the costs determined to be reasonable are at the 60th percentile of costs reported by nursing homes in the class, the state may set its reasonable cost-related reimbursement rate at the 60th percentile of the class' allowable costs."

(HCFA, 1977, p. 9). In other words, the state has a wide latitude in determining what is reasonable, provided that it applies this rate to all homes and the determination be made from industry-wide experience. All that is required in terms of relating rate "incentives" to achieve policy goals is that the "incentive" be determined from industry-wide experience. Thus, the incentive could be one standard deviation of the mean of a particular cost variable for historically produced product attributes

The reasonable cost-related payment of product attributes not currently produced, or not currently measured in current data sources, is more difficult. For example, if public policymakers wish to reward facilities which offer their residents the option of furloughs, or which offer choice of meals, it will be difficult to assign an historical base cost to these attributes; they are currently not widely offered in the marketplace and/or are not included in data that could be used to define current products. In addition, if certain current product attributes are determined to be undersupplied, it is clear that, while the incremental costs of facilities that do supply them to public patients are probably at least covered by current rates, it may be necessary to pay more than current costs to induce more facilities to supply these types of care. For example, if the public payment program wishes there to be more nursing homes in rural areas, it is not sufficient merely to compare past costs of urban and rural homes. That there are too few rural homes is ipso facto, evidence that the current cost differential does not reflect the costs of the additional desired homes, because of the way rates are currently set. The cost of these new homes can be determined only after analyzing what rate is sufficient to obtain the desired number of rural homes. Thus, the incentive cannot be determined technically from historical data. Only trial-and-error experimentation can be used to "fine tune" the parameters of the formula, and cost estimates can only be used as an initial base for this effort.

6.5 Afterward

The thrust of this report has been to argue that the government's reimbursement policy towards nursing home care should be designed to achieve the goals of public policy. If the government wants to achieve quality care, then it should create incentives for facility operators to incur costs of producing quality care; if access is what the government wants, then it must be willing to pay for the additional costs of increased access. These

statements, however, do not directly relate to the nature of the nursing home product. The currently widely circulating model of nursing home care is oriented around a medical illness model. For example, current proxies for quality of care are in terms of medical inputs: nursing hours, medical tests, nursing services, etc. In brief, the costs that reimbursement systems incur are the costs of a medically oriented style of care.

Such a view of nursing home care minimizes considerations of quality of life. Nursing homes are the residual place of residence for the elderly. While many persons are too debilitated to maintain themselves in activities of daily living, they are still part of a living social environment. Yet typical care in many nursing homes is designed to lead the residents towards more, not less dependency. The way of life fostered by nursing home reimbursement policy could be changed. For example, social services of all forms are possible for the elderly including occupational, rehabilitational, social, and physical therapists.

The quality of life of residents of nursing homes is an illusive concept, yet one which can be augmented to the extent that the reimbursement rate creates incentives for incurring such costs. The point is that <u>if the government can describe what it wants and if it is willing to pay for it</u>, then it should be possible to establish incentives for congruent types of nursing home operator behavior (which need not necessarily be more costly than care under a medical model). Until states (and the federal government) are willing to pay for the type and level of care they say they want, problems of nursing home reimbursement will remain at issue.

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